

DOCUMENT RESUME

ED 156 922

CE 017 450

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 TITLE Bricklaying Curriculum. Instructional Units.
 INSTITUTION Associated General Contractors of America, Washington, D.C.; Oklahoma State Dept. of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.
 PUB DATE 77
 NOTE 788p.; Some diagrams are marginally legible due to type size
 AVAILABLE FROM Associated General Contractors, 1957 East Street, N.W., Washington, D.C. 20006 (Teacher, \$25.00; Student, \$20.00)
 EDRS PRICE MF-\$1.50 Plus Postage. HC Not Available from EDRS.
 DESCRIPTORS Arithmetic; Audiovisual Aids; *Bricklaying; *Building Materials; Cleaning; Construction (Process); Criterion Referenced Tests; Curriculum Guides; Employer Employee Relationship; Equipment; *Job Skills; Learning Activities; Learning Modules; Objectives; Performance Based Education; Problem Solving; Promotion (Occupational); Safety; Shop Curriculum; *Trade and Industrial Education

ABSTRACT

To assist bricklaying instructors in providing comprehensive instruction to their students, this curriculum guide treats both the skills and information necessary for bricklaying in commercial and industrial construction. Eight instructional units are included, as follow: general orientation; tools and equipment; safety; materials; human relationships and leadership, focusing on characteristics desirable in employees; related information such as basic arithmetic and ratio and proportion problem solving; shop practices; and cleaning, pointing, and caulking. Each unit consists of eight sections: (1) student behavioral objectives, which state the goals of the course; (2) suggested activities, outlining steps for both students and instructors to accomplish specific objectives; (3) information sheets, which provide the content necessary to meet the knowledge objectives of the unit; (4) transparency masters to reinforce the learning process; (5) job sheets, which outline the skills being taught; (6) assignment sheets for homework or classroom use (answer sheets are also included); (7) paper-pencil and performance tests constructed to measure student achievement of each objective; and (8) test answers. (ELG)

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ED156922

BRICKLAYING CURRICULUM

Instructional Units

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and

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U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

1977

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Edited by
State Department of Vocational and Technical Education
Stillwater, Oklahoma

Distributed by
Associated General Contractors of America
1957 E Street, N.W., Washington, D.C. 20006
and the
Curriculum and Instructional Materials Center
State Department of Vocational and Technical Education
Stillwater, Oklahoma 74074

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FOREWORD

In 1975, the Associated General Contractors of America met with representatives of the Oklahoma Curriculum and Instructional Materials Center to discuss the possibility of developing, as a cooperative project, a course of instruction that would be especially designed for training the bricklayer who will make his career in industrial and commercial construction.

This publication is the result of this discussion. It is the product of close coordination between general contractors, men who actually work in construction, and vocational-technical educators. It represents a conscious effort to mold the practical experience of personnel from the world of construction with the best instructional methods available from the world of education.

The trainers of construction craftsmen are faced with the challenge of providing thorough and modern training to the backbone of the construction industry, its work force. The purpose of this manual is to assist bricklaying instructors in providing a uniformly high caliber of thorough instruction to their student craftsmen. This publication should be supplemented by each instructor's own methods and materials. The information in the manual may be adapted to coincide with local conditions that dictate modification in content or method.

Dr. Francis T. Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

William L. Pemberton, Chairman
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America

PREFACE

For many years contractors and those responsible for training bricklayers have felt the need for instructional material to be used in training the bricklayer. The Associated General Contractors of America with the cooperation and support of the Oklahoma State Department of Vocational-Technical Education, Curriculum Center, have accepted the challenge to produce a manual for use in training the bricklayer in those areas in which he is expected to be proficient.

Instructional material in this manual is written in terms of student performance using measurable behavioral objectives. This is an innovative approach to teaching which accents and augments the teaching-learning process. Criterion-referenced evaluation instruments provide for a uniform measurement of student progress.

Bricklaying instructors are faced with the challenge of providing students with the skill and related information necessary to meet the demands of a changing profession. Competition for jobs is greater than ever. Therefore, the bricklayer must be better trained and better equipped to find and retain meaningful employment.

The purpose of this manual is to assist bricklaying instructors in providing instruction throughout the industry. This publication should be supplemented by each instructor's methods and materials. Any information in this manual that does not concur with the instructor's course of study can very easily be modified to meet his needs.

Raymond Turcotte

Bob Patton

Clifton R. (Pete) Braker

ABOUT THE AUTHOR



Raymond J. Turcotte was born in 1917 in Worcester, Massachusetts. He received his early training from his father and while attending the Boys Trade School in Worcester from 1932 to 1936.

Encouraged by his father, also a bricklayer and a member of Local Union #6, Ray joined the Bricklayers, Masons, and Plasterers International Union of America, Local Union #6 of Worcester, Massachusetts, in 1936. He served his apprenticeship with J. W. Bishop Company, General Contractors, from 1936 to 1939. He continued his employment with the J. W. Bishop Company as a journeyman bricklayer until 1942. He then worked for the J. S. Prunier and Sons Brick and Plastering Company for ten years as a journeyman bricklayer and as a masonry superintendent. For two years he was employed by the J. B. Lowell Company, General Contractors, as a masonry superintendent.

In 1954, Ray started with the F. W. Madigan Company, General Contractors, as a masonry superintendent and has continued his employment there for 22 years as a masonry and building superintendent.

Ray received his 40 year pin in July 1976. For the development of this bricklayer's manual, his forty years of experience were loaned to the Associated General Contractors of America. During this period, he served as a member of the staff of the Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center.

ACKNOWLEDGEMENTS

Appreciation is expressed to the many individuals and companies who gave their time and knowledge in the preparation of this manual.

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We are grateful to the following individuals and companies for their technical support during the development of this curriculum.

Thomas Murphy, President, International Union of Bricklayers
and Allied Craftsmen, Washington, D.C.
Merlin L. Taylor, Assistant to the President, International Union of Bricklayers and Allied
Craftsmen, Washington, D.C.
F. W. Madigan Co., Worcester, Massachusetts
Ken Green, Project Manager, F. W. Madigan Co., Worcester, Massachusetts
National Concrete Masonry Association, McLean, Virginia
Tremco Manufacturing Company, Cleveland, Ohio
Dur-O-Wall Products
Indiana Limestone Institute, Bloomington, Indiana
Concrete Masonry Association of California
Portland Cement Association, Skokie, Illinois
Korfil, Chicopee, Massachusetts
Henry Camosse and Sons, Inc., Worcester, Massachusetts
W. R. Grace Company, Cambridge, Massachusetts
Grefco Inc., Building Products Division, Los Angeles, California
Brick Institute of America, McLean, Virginia
Edward Canterbury, Masonry Instructor, Indian Meridian Area Vo-Tech School,
Stillwater, Oklahoma

A special thanks to Francis W. Madigan, Sr. and Francis "Bud" Madigan II for providing the writer with the opportunity to participate in this project.

Gratitude is expressed to Sheila Stone for editing, to Flo Eubanks and Sandy Thompson for assistance with research, and to Cindy Johnson, Karen Howell, and the Graphics Division for typing.

Special appreciation goes to Bob Patton, Coordinator, Curriculum and Instructional Materials Center; Bob Rea, Manager of Art and Layout; Mike Adair, Jon Dickey, and Paul Evans, Illustrators.

To the rest of the Curriculum and Instructional Materials staff we also say thanks: Ivan Armstrong, T & I Specialist; Eddie Smith, Vocational Agriculture Specialist; Frank Nelson, Cooperative Specialist; Joyce Sawatzky, Home Economics Specialist; Helen Rogers, Health Occupations Curriculum Writer; Sarah Mussett, Editor; Mary Kay Jennings, Barbara Reed, Sandra Lewis, Linda Lenington, Suzanne Hiney, all a part of the support staff; and Karen Thomas, Business and Office Manager.

USE OF THIS PUBLICATION

Instructional Units

Bricklaying Curriculum includes eight sections. Each section consists of one or more units of instruction. Each instructional unit includes behavioral objectives, suggested activities for instructors and students, information sheets, assignment sheets, job sheets, visual aids, tests, and answers to tests. Units are planned for more than one lesson or class period of instruction.

Careful study of each instructional unit by the teacher will help him determine:

- A. The amount of material that can be covered in each class period.
- B. The skills which must be demonstrated.
 - 1. Supplies needed
 - 2. Equipment needed
 - 3. Amount of practice needed
 - 4. Amount of class time needed for demonstrations
- C. Supplementary materials such as pamphlets and filmstrips that must be ordered.
- D. Resource people that must be contacted.

Objectives

Each unit of instruction is based on behavioral objectives. These objectives state the goals of the course, thus providing a sense of direction and accomplishment for the student.

Behavioral objectives are stated in two forms: terminal objectives, stating the subject matter to be covered in a unit of instruction, and specific objectives, stating the student performance necessary to reach the terminal objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the instructor and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms which were used in this material:

<u>Name</u>	<u>Identify</u>	<u>Describe</u>
Label	Select	Define
List in writing	Mark	Discuss in writing
List orally	Point out	Discuss orally
Letter	Pick out	Interpret
Record	Choose	Tell how
Repeat	Locate	Tell what
Give		Explain

Order

Arrange
Sequence
List in order
Classify
Divide
Isolate
Sort

Distinguish

Discriminate

Construct

Draw
Make
Build
Design
Formulate
Reproduce
Transcribe
Reduce
Increase
Figure

Demonstrate

Show your work
Show procedure
Perform an experiment
Perform the steps
Operate
Remove
Replace
Turn off/on
(Dis) assemble
(Dis) connect

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Instructors should feel free to add objectives which will fit the material to the needs of the students and community. When an instructor adds objectives, he should remember to supply the needed information, assignment and/or job sheets, and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. The activities are listed according to whether they are the responsibility of the instructor or the student.

Instructor: Duties of the instructor will vary according to the particular unit; however, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and job sheets; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss terminal and specific objectives and information sheet; give test. Instructors are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Students: Student activities are listed which will help the student to achieve the objectives for the unit.

Information Sheets

Information sheets provide content essential for meeting the cognitive (knowledge) objectives of the units. The instructor will find that information sheets serve as an excellent guide for presenting the background knowledges necessary to develop the skills specified in the terminal objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheets. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Job Sheets

Job sheets are an important segment of each unit. The instructor should be able to and in most situations should demonstrate the skills outlined in the job sheets. Procedures outlined in the job sheets give direction to the skill being taught and allow both student and teacher to check student progress toward the accomplishment of the skill. Job sheets provide a ready outline for a student to follow if he has missed a demonstration. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this training.

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledges which are necessary prerequisites to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or instructor for checking student progress.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and will help the instructor spot difficulties being encountered by students in their efforts to accomplish the terminal objective. Test items for objectives added by the instructor should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the instructor and/or student for checking student achievement of the objectives.

Page Numbering System

Each section in this publication is assigned a specific letter: (A) Orientation; (B) Tools and Equipment; (C) Safety; (D) Materials; (E) Human Relations and Leadership; (F) Related Information; (G) Shop Practices; (H) Cleaning, Pointing, and Caulking. Pages are numbered consecutively within each section. For example, Tools and Equipment covers pages 1-B through 97-B. If the page is available as a transparency master, TM appears at the bottom of the page.

The following key will help to easily identify each section by color:

White	-	Objectives, Suggested Activities, and Transparency Masters
Green	-	Information Sheets
Buff	-	Assignment Sheets
Blue	-	Job Sheets
Yellow	-	Tests
Pink	-	Answers to Assignment Sheets and Answers to Tests

(NOTE: This publication will provide unity of instruction throughout the nation in teaching bricklaying. The effectiveness of this publication will depend on you as an instructor.)

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(NOTE: This is an alphabetized list of the publications used in completing this manual.)

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ORIENTATION UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name employment opportunities for the bricklayer and select factors concerning the occupational outlook for the bricklaying trade. The student should be able to list student requirements and major skills needed and complete a personal information form. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with orientation to the correct definitions.
2. Name employment opportunities for the bricklayer.
3. Select from a list factors concerning the occupational outlook for the bricklaying trade.
4. List the student requirements for the bricklaying program.
5. Name the major skills needed by the bricklayer.
6. Complete a personal information sheet.

ORIENTATION UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Discuss terminal and specific objectives.
- D. Discuss information and assignment sheets.
- E. Give test.

(NOTE: Instructors may want to ask a person who employs bricklayers to talk to the class about opportunities for employment in the local community.)

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Complete assignment sheet.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Assignment Sheet #1--Personal Information Sheet
- D. Test
- E. Answers to test

II. References:

- A. *Occupational Outlook Handbook*. Bulletin no. 1650. Washington, D.C.: U.S. Department of Labor Statistics, 1970-71.
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ORIENTATION
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Skill--Ability to use tools of the trade proficiently
- B. Trade--Job or group of related skills within an occupation
- C. Bricklayer--Person that is employed in the bricklaying trade
- D. Occupation--Group of related jobs which make up the work a person does regularly to make a living

Example: Tender, foreman, superintendent

II. Employment opportunities

- A. Independent and union affiliated residential building contractors
- B. Independent and union affiliated commercial contractors
- C. Prefabrication industry
- D. Refractory industry
- E. Remodeling and repair of older buildings

III. Factors concerning occupational outlook

- A. Employment opportunities due to mortality and retirement of bricklayers
- B. Increased population

(NOTE: Employment increases as population increases.)

- C. New concepts in masonry construction

IV. Student requirements for the bricklaying program

- A. Use all tools properly
- B. Be safety conscious and follow safety regulations
- C. Take instructions readily and follow directions
- D. Be a good citizen
- E. Control temper at all times
- F. Display enthusiasm at work

INFORMATION SHEET

- G. Exhibit pride in bricklaying trade
- H. Practice conservation of materials and man-hours
- I. Be punctual
- J. Be responsible

(NOTE: Others may be added by instructor.)

V. Major skills needed by the bricklayer

- A. Use of hand tools
- B. Use of power tools and equipment
- C. Measuring
- D. Reading blueprints
- E. Layout
- F. Materials estimating
- G. Construction

ORIENTATION
UNIT I

ASSIGNMENT SHEET #1-PERSONAL INFORMATION SHEET

Name _____ Class _____

Home address _____

Home phone _____

Parents' names (or guardian) _____

Wife (if married) _____

Parents' occupations _____

Name and phone number of person to call in case of emergency _____

Family doctor _____

List shop courses completed _____

Skill experience _____

Name of insurance company _____

Comments:

ORIENTATION
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

☐ a. Ability to use tools of the trade proficiently	1. Bricklayer
☐ b. Person that is employed in the bricklaying trade	2. Skill
☐ c. Group of related jobs which make up the work a person does regularly to make a living	3. Trade
☐ d. Job or group of related skills within an occupation	4. Occupation
2. Name three employment opportunities for the bricklayer.
 - a.
 - b.
 - c.
3. Select from the list below factors concerning the occupational outlook for the bricklaying trade by placing an "X" in the blanks.

☐ a. New concepts in masonry construction
☐ b. New concepts in concrete construction
☐ c. Increased population
☐ d. Employment opportunities due to mortality and retirement of brick masons
☐ e. President's work aid program
4. List six student requirements for the bricklaying program.
 - a.
 - b.
 - c.

- d.
 - e.
 - f.
5. Name four major skills needed by the bricklayer.
- a.
 - b.
 - c.
 - d.
6. Complete a personal information sheet.

(NOTE: If this activity has not been accomplished prior to the test, ask the instructor when it should be completed.)

ORIENTATION
UNIT I

ANSWERS TO TEST

- a. 2
 - b. 1
 - c. 4
 - d. 3
2. Any three of the following:
- a. Independent and union affiliated residential building contractors
 - b. Independent and union affiliated commercial contractors
 - c. Prefabrication industry
 - d. Refractory industry
 - e. Remodeling and repair of older buildings
3. a, c, d
4. Any six of the following:
- a. Use all tools properly
 - b. Be safety conscious and follow safety regulations
 - c. Take instructions readily and follow directions
 - d. Be a good citizen
 - e. Control temper at all times
 - f. Display enthusiasm at work
 - g. Exhibit pride in bricklaying trade
 - h. Practice conservation of materials and man-hours
 - i. Be punctual
 - j. Be responsible

(NOTE: Others may be added by the instructor.)

5. Any four of the following:
 - a. Use of hand tools
 - b. Use of power tools and equipment
 - c. Measuring
 - d. Reading blueprints
 - e. Layout
 - f. Materials estimating
 - g. Construction
6. Evaluated to the satisfaction of the instructor

Student's Name _____

Section A
Orientation

Unit I
Orientation

1

2

Unit Test

Job

Complete a Personal Information Sheet

Student's Name

1

2

3

4

5

6

7

8

BRICKLAYING PROGRESS CHART

Section A Orientation

Student's Name

[illegible]



HAND TOOLS UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify hand tools of the bricklaying trade and match tools to specific job use. The student should be able to name factors to consider in selecting tools and name basic rules concerning care and safe use of tools. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with brick and block laying to the correct definitions.
2. Identify types of jointers.
3. Match types of jointers to specific job use.
4. Identify types of hammers.
5. Match types of hammers to specific job use.
6. Distinguish between a regular spacing rule and a brick spacing rule.
7. Identify types of squares.
8. Match types of squares to specific job use.
9. Identify tools used in determining course alignment.
10. Identify miscellaneous tools of the bricklaying trade.
11. Match miscellaneous tools to the specific job use.
12. Identify the parts of a brick trowel.
13. Name factors to consider in selecting a brick trowel.
14. List basic rules concerning care of the level.
15. Name basic rules concerning care of hand tools.
16. Name basic rules for the safe use of hand tools.

HAND TOOLS UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Show examples of tools and demonstrate proper use.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 1. TM 1--Types of Jointers
 2. TM 2--Types of Hammers
 3. TM 3--Spacing Rules
 4. TM 4--Types of Squares
 5. TM 5--Tools for Alignment

- 6. TM 6--Miscellaneous Tools
- 7. TM 7--Parts of a Brick Trowel

D. Test

E. Answers to test

II. References:

- A. Hendrix, Laborn, and Patton, Bob. *Cement Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education, 1975.
- B. Toennies, Henry, and Merten, John E. *Concrete Masonry Vocational Training*. McLean, Virginia: National Concrete Masonry Association, 1973.
- C. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. McLean, Virginia: Structural Clay Products Institute, 1973.

HAND TOOLS UNIT I

INFORMATION SHEET

- I. Terms and definitions
 - A. Jointer--Tool used for smoothing mortar joints
 - B. Brick set--Tool used for cutting brick or block
 - C. Trowel--Tool used to apply, spread, shape, or smooth mortar when laying brick or block
 - D. Chalk line--Line containing a chalk substance used for laying out first course of brick or block
 - E. Line block--Piece of plastic or wood used to keep line tight
 - F. Line pin--Piece of metal used for securing a line at both ends of the course height
- II. Types of jointers (Transparency 1)
 - A. Round
 - B. Flat
 - C. Rake
 - D. Sled runner
 - E. Beaded
 - F. Grapevine
 - G. Vee
 - H. Tuck jointer
- III. Jointers and their uses
 - A. Round
 1. Weatherproof joints
 2. Compress joints
 3. Give concave appearance
 - B. Flat--Compress and shape mortar joints
 - C. Rake--Make attractive interior design

INFORMATION SHEET

IV. Types of hammers (Transparency 2)

A. Brick

B. Tile

(NOTE: The tile and brick hammers are similar in appearance. The tile hammer is lighter in weight and smaller in size.)

C. Plug or mash

V. Hammers and their uses

A. Brick

1. Strike brick set

2. Cut brick or block

B. Tile-Cut tile

C. Plug or mash-Strike chisel when cutting holes in existing masonry walls

VI. Spacing rules (Transparency 3)

A. Modular rule

(NOTE: Modular spacing refers to the course height.)

B. Regular rule

(NOTE: A six-foot folding rule is used for general measuring.)

C. Brick spacing rule

(NOTE: Brick spacing rule refers to the brick course height.)

VII. Types of squares (Transparency 4)

A. Steel framing

B. Combination

(NOTE: This may also be referred to as a miter square.)

C. Bevel

(NOTE: This may also be referred to as a T-bevel.)

INFORMATION SHEET

VIII. Squares and their uses

A. Steel framing square

1. Square corners
2. Measure and mark
3. Plumb

B. Combination square

1. Mark
2. Level
3. Mark cuts of various angles

C. Bevel square

1. Mark cuts of various angles
2. Mark skewbacks

IX. Tools for alignment (Transparency 5)

A. Chalk line

(NOTE: The chalk line is used for marking wall line or building line.)

B. Mason's line

(NOTE: It is a nylon or cotton line used for keeping brick level, straight, and plumb.)

C. Line block

(NOTE: Line blocks are used to secure line to established corners.)

D. Line pin

(NOTE: Line pins are used to secure the line.)

E. Trig

(NOTE: The trig is used to prevent line sag and to prevent movement from wind.)

INFORMATION SHEET

- X. Miscellaneous tools (Transparency 6)
 - A. Utility knife
 - B. Bolt cutter
 - C. Tuck pointer
 - D. Brush
- XI. Miscellaneous tools and their uses
 - A. Utility knife
 - 1. Cut fabric flashing
 - 2. Sharpen pencil
 - B. Bolt cutter--Cut wire reinforcing
 - C. Tuck pointer--Tuck and point mortar in open joints
 - D. Brush--Brush down walls that have been jointed
- XII. Parts of the brick trowel (Transparency 7)
 - A. Blade
 - B. Frog
 - C. Heel
 - D. Ferrule
 - E. Shank
 - F. Handle
- XIII. Factors to consider in selecting a brick trowel
 - A. Well balanced
 - B. Shape of blade
 - C. Light in weight
 - D. Flexible blade
 - E. Proper angle of blade to handle
 - F. Fine grade of steel for blade

INFORMATION SHEET

XIV. Care of level

- A. Rub wooden level with linseed oil regularly
- B. Do not tap level with trowel, hammer, or any other instrument
- C. Keep level in an upright position
- D. Check level with another level that has already been checked
- E. Keep windows on level clean

XV. Care of hand tools

- A. Keep all tools clean
- B. Keep brick hammer sharp and square
- C. Keep folding rule oiled

XVI. Basic rules for the safe use of hand tools

- A. Use the right tool for the job
- B. Do not use trowel for hammer
- C. Keep brick hammer handle tight in the eye of hammer
- D. Do not use brick hammer for cutting holes in brick or block walls
- E. Keep cutting edge of brick set sharp and top of striking end free of burring
- F. Do not hammer on level
- G. Wear safety goggles when cutting

Types of Jointers



Flat



Round



Beaded



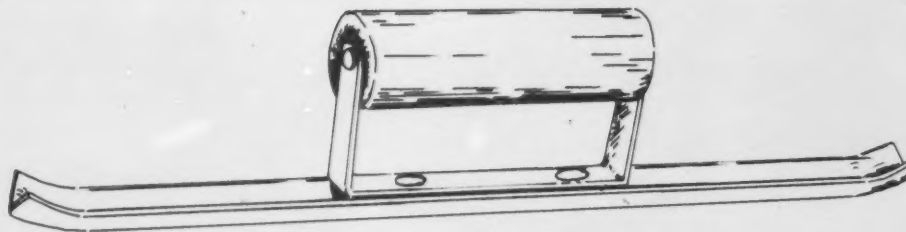
Rake



Tuck Pointer



Grapevine



Sled Runner

Types of Hammers



Plug or Mash

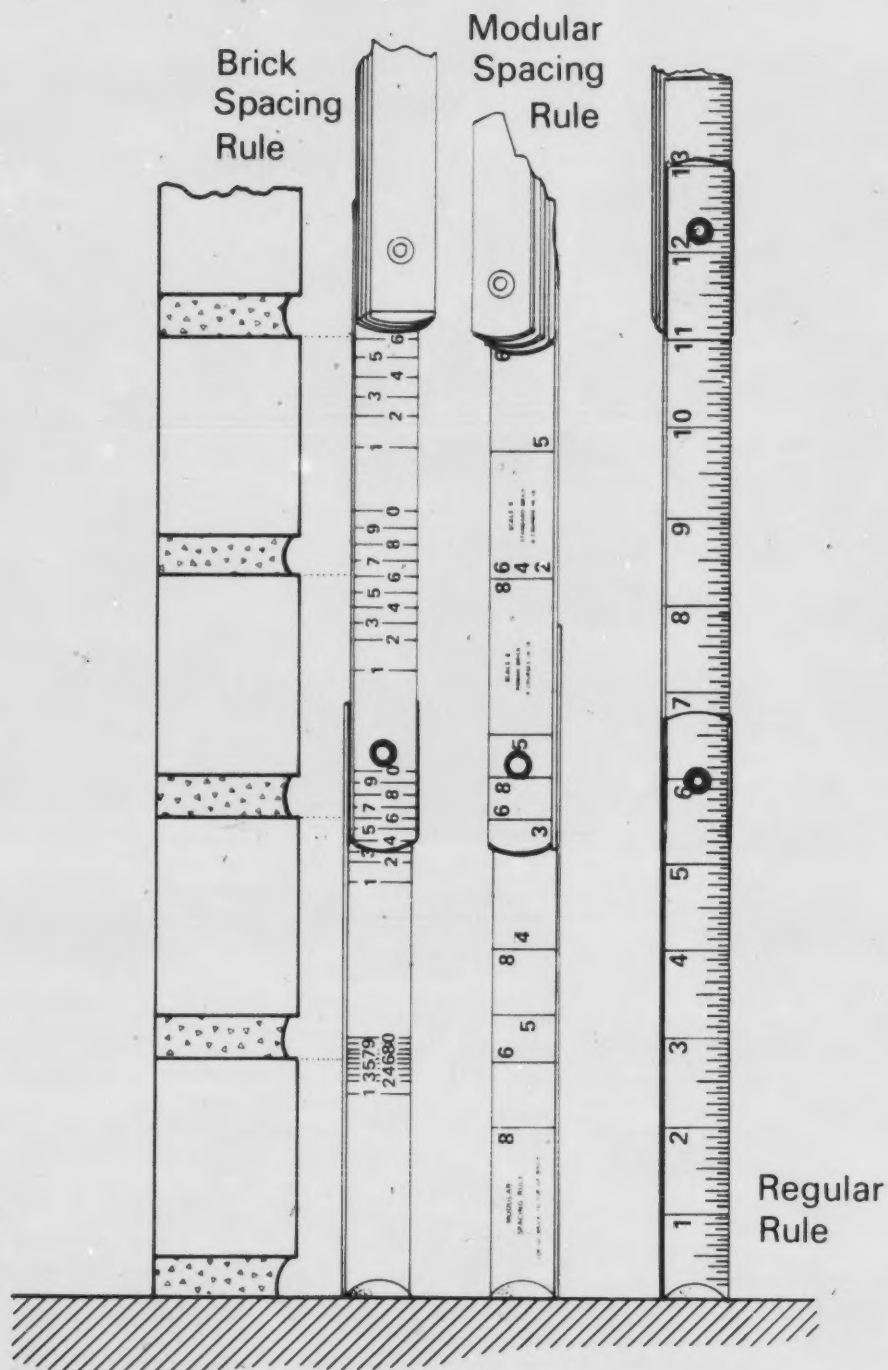


Brick

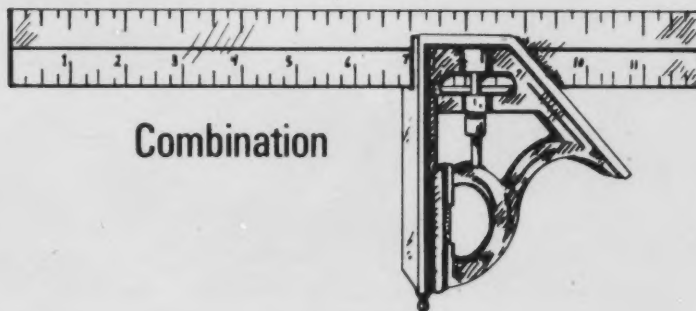


Tile

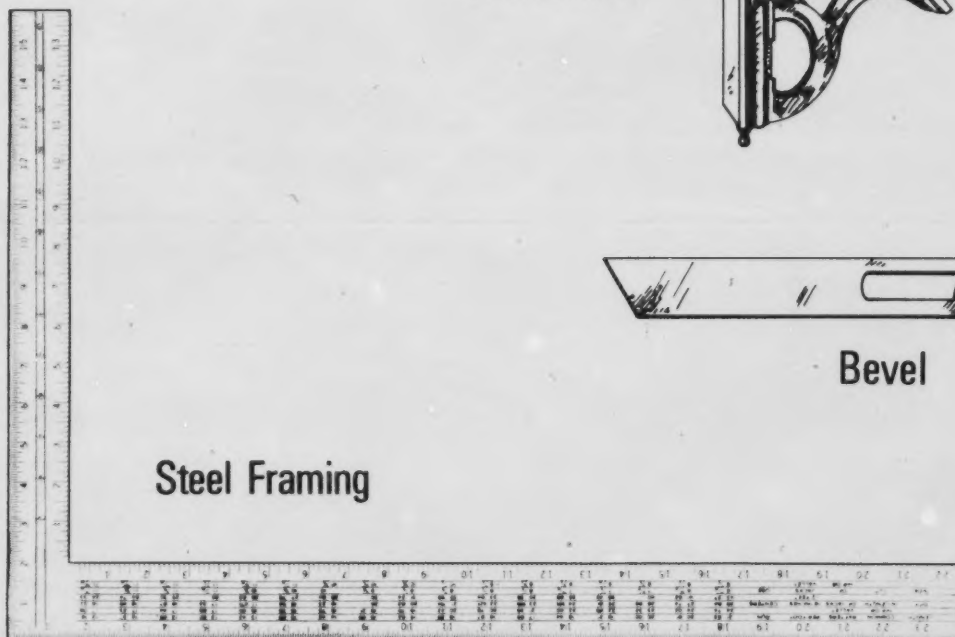
Spacing Rules



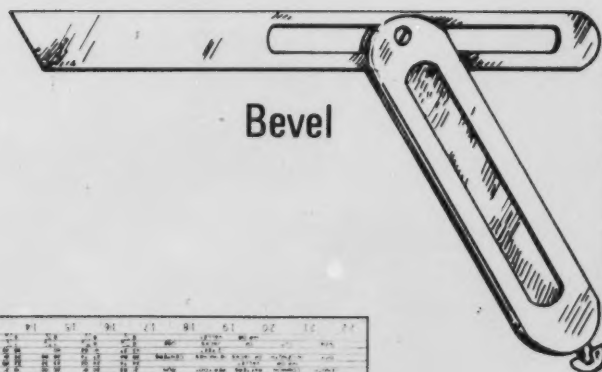
Types of Squares



Combination



Steel Framing

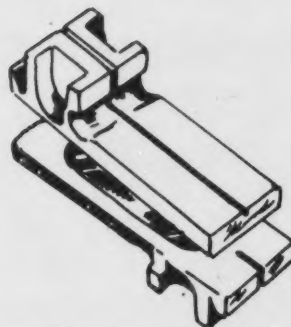


Bevel

Tools for Alignment



Mason's Line



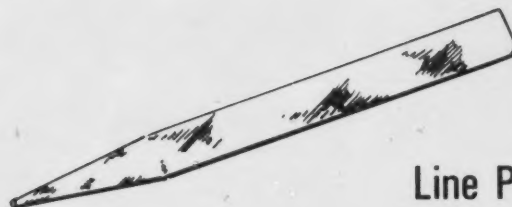
Line Block



Chalk Line



Trig

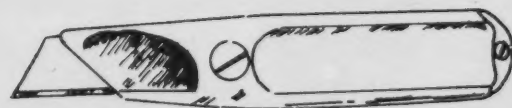


Line Pin

Miscellaneous Tools



Bolt Cutter



Utility Knife

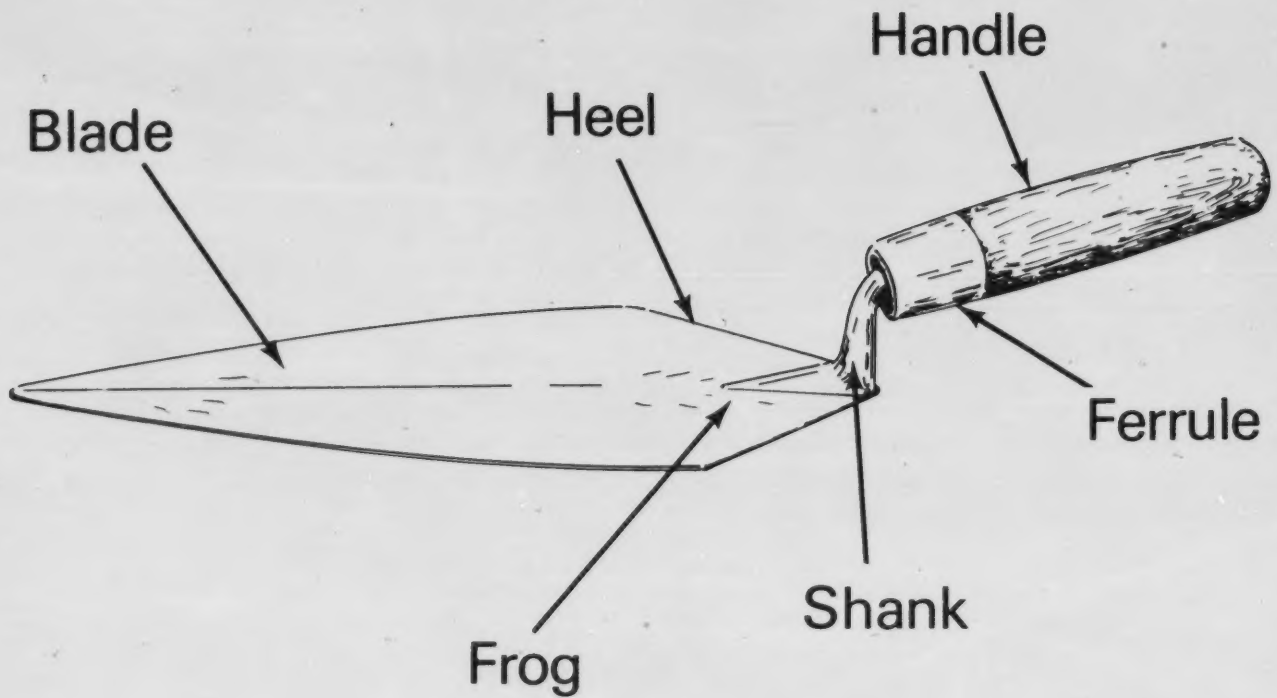


Brush



Tuck Pointer

Parts of a Brick Trowel



HAND TOOLS UNIT I

TEST

1. Match the terms on the right to the correct definitions.

_____ a. Tool used for smoothing mortar joints	1. Brick set
_____ b. Piece of metal used for securing a line at both ends of the course height	2. Trowel
_____ c. Tool used to apply, spread, shape, or smooth mortar when laying brick or block	3. Chalk line
_____ d. Tool used for cutting brick or block	4. Jointer
_____ e. Line containing a chalk substance used for laying out first course of brick or block	5. Line block
_____ f. Piece of plastic or wood used to keep line tight	6. Line pin

2. Identify the types of jointers shown below by writing the correct names on the blanks.



a. _____



b. _____



c. _____



d. _____



f. _____



e. _____

3. Match the types of jointers on the right to the specific job use. Answers may be used more than once.

- | | |
|---|----------|
| _____ a. Weatherproof joints | 1. Rake |
| _____ b. Give concave appearance | 2. Round |
| _____ c. Make attractive interior design | 3. Flat |
| _____ d. Compress and shape mortar joints | |
| _____ e. Compress joints | |

4. Identify the types of hammers shown below.



a. _____



b. _____

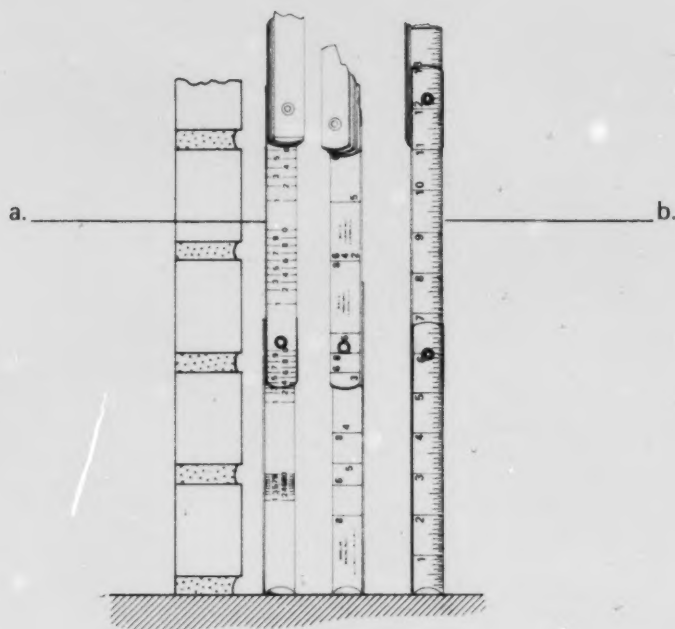


c. _____

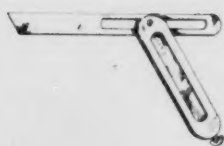
5. Match the types of hammers on the right to the specific job use. Answers may be used more than once.

- | | |
|---|-----------------|
| _____ a. Cut brick or block | 1. Tile |
| _____ b. Cut tile | 2. Brick |
| _____ c. Strike chisel when cutting holes in existing masonry walls | 3. Plug or mash |
| _____ d. Strike brick set | |

6. Distinguish between a regular spacing rule and a brick spacing rule by placing an "X" in the blank indicating a brick spacing rule.



7. Identify the types of squares shown below.



a. _____



b. _____



c. _____

8. Match the types of squares on the right to the specific job use by placing the appropriate number or numbers in the blanks provided.

_____ a. Mark	1. Steel framing
_____ b. Mark cuts of various angles	2. Bevel
_____ c. Mark skewbacks	3. Combination
_____ d. Square corners	
_____ e. Level	
_____ f. Plumb	
_____ g. Measure and mark	

9. Identify the following tools used in determining course alignment.



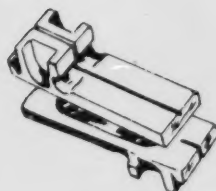
a. _____



b. _____



c. _____

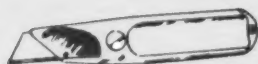


d. _____



e. _____

10. Identify the following tools.



a. _____



b. _____



c. _____



d. _____

11. Match the types of miscellaneous tools on the right to the specific job use. Answers may be used more than once.

_____ a. Sharpen pencil

_____ b. Tuck and point mortar in open joints

_____ c. Cut wire reinforcing

_____ d. Cut fabric flashing

_____ e. Brush down walls that have been jointed

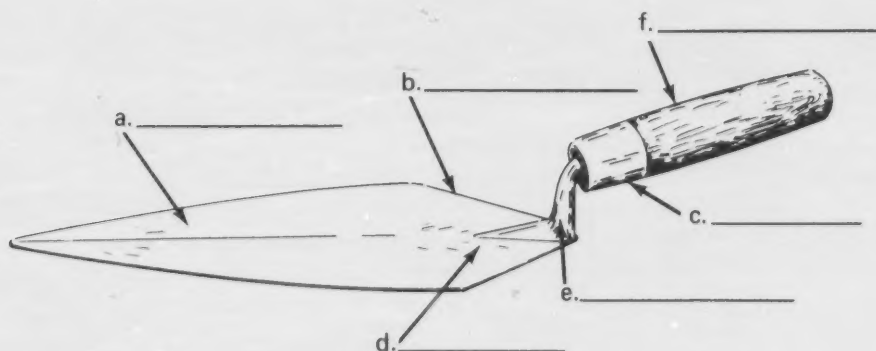
1. Utility knife

2. Bolt cutter

3. Brush

4. Tuck pointer

12. Identify the parts of the brick trowel illustrated below.



13. Name three factors to consider in selecting a brick trowel.
 - a.
 - b.
 - c.
14. List three basic rules concerning care of the level.
 - a.
 - b.
 - c.
15. Name three basic rules concerning care of hand tools.
 - a.
 - b.
 - c.
16. Name three basic rules for the safe use of hand tools.
 - a.
 - b.
 - c.

HAND TOOLS
UNIT I

ANSWERS TO TEST

- | | | | | |
|----|----|--------------|----|---|
| 1. | a. | 4 | d. | 1 |
| | b. | 6 | e. | 3 |
| | c. | 2 | f. | 5 |
| 2. | a. | Round | | |
| | b. | Flat | | |
| | c. | Rake | | |
| | d. | Beaded | | |
| | e. | Sled runner | | |
| | f. | Grapevine | | |
| 3. | a. | 2 | | |
| | b. | 2 | | |
| | c. | 1 | | |
| | d. | 3 | | |
| | e. | 2 | | |
| 4. | a. | Brick | | |
| | b. | Tile | | |
| | c. | Plug or mash | | |
| 5. | a. | 2 | | |
| | b. | 1 | | |
| | c. | 3 | | |
| | d. | 2 | | |
| 6. | a. | | | |

- 7.
 - a. Bevel
 - b. Steel framing
 - c. Combination
- 8.

a. 1, 2, 3	d. 1	g. 1
b. 2, 3	e. 3	
c. 2	f. 1	
- 9.
 - a. Trig
 - b. Chalk line
 - c. Line pin
 - d. Line block
 - e. Mason's line
- 10.
 - a. Utility knife
 - b. Bolt cutter
 - c. Brush
 - d. Tuck pointer
- 11.
 - a. 1
 - b. 4
 - c. 2
 - d. 1
 - e. 3
- 12.
 - a. Blade
 - b. Heel
 - c. Ferrule
 - d. Frog
 - e. Shank
 - f. Handle

13. Any three of the following:
- a. Well balanced
 - b. Shape of blade
 - c. Light in weight
 - d. Flexible blade
 - e. Proper angle of blade to handle
 - f. Fine grade of steel for blade
14. Any three of the following:
- a. Rub wooden level with linseed oil regularly
 - b. Do not tap level with trowel, hammer, or any other instrument
 - c. Keep level in an upright position
 - d. Check level with another level that has already been checked
 - e. Keep windows on level clean
15. a. Keep all tools clean
- b. Keep brick hammer sharp and square
- c. Keep folding rule oiled
16. Any three of the following:
- a. Use the right tool for the job
 - b. Do not use trowel for hammer
 - c. Keep brick hammer handle tight in the eye of hammer
 - d. Do not use brick hammer for cutting holes in brick or block walls
 - e. Keep cutting edge of brick set sharp and top of striking end free of burring
 - f. Do not hammer on level
 - g. Wear safety goggles when cutting

POWER TOOLS UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify power tools used by the bricklayer and match power tools to specific job use. The student should be able to identify types of scaffolds and name safety factors to consider when operating a masonry table saw. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with power tools to the correct definitions.
2. Identify power tools used by the bricklayer.
3. Identify the parts of the masonry table saw.
4. Name types of cutting blades used on a masonry table saw.
5. Identify types of scaffolds.
6. Match power tools to specific job use.
7. Name factors to consider in caring for the masonry table saw.
8. Name safety rules to follow when operating the masonry table saw.
9. Demonstrate the ability to:
 - a. Cut masonry units using a masonry table saw with an abrasive blade.
 - b. Cut masonry units using a masonry table saw with a diamond blade.

POWER TOOLS
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Show examples of tools and demonstrate proper use.
- G. Demonstrate and discuss procedures outlined on the job sheets.
- H. Supervise students using masonry table saw.
- I. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Types of Power Tools
 - 2. TM 2--Parts of a Masonry Table Saw

3. TM 3--Types of Cutting Blades

4. TM 4--Types of Scaffolds

D. Job sheets

1. Job Sheet #1--Cut Masonry Units Using Masonry Table Saw with Abrasive Blade

2. Job Sheet #2--Cut Masonry Units Using Masonry Table Saw with Diamond Blade

E. Test

F. Answers to test

II. References:

A. Hendrix, Laborn, and Patton, Bob. *Cement Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education, 1975.

B. Toennies, Henry, and Merten, John E. *Concrete Masonry Vocational Training*. McLean, Virginia: National Concrete Masonry Association, 1973.

POWER TOOLS
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Masonry table saw--Power-driven table saw used for cutting masonry units
- B. Scaffold--Temporary structure or platform used to support workmen and materials at each staging height during construction

(NOTE: Each staging height is normally referred to as five feet.)

- C. Pneumatic caulking gun--Air-driven gun used for placing a caulking substance around window and door openings

(NOTE: Caulking gun can also be used on expansion and control joints.)

- D. Pressure cleaner--Equipment used by the bricklayer in cleaning masonry walls
- E. Power hammer--Air-driven hammer used for chipping and cutting masonry holes
- F. Hammer drill--Tool used for drilling holes
- G. Sheetrock screwdriver--Tool used for attaching metal ties
- H. Skill saw--Power-driven tool used for removing mortar bed joints and cutting raggles

II. Power tools used by bricklayer (Transparency 1)

- A. Masonry table saw
- B. Skill saw
- C. Hammer drill
- D. Power hammer
- E. Pneumatic caulking gun
- F. Sheetrock screwdriver
- G. Pressure cleaner

INFORMATION SHEET

III. Parts of masonry table saw (Transparency 2)

- A. Motor
- B. On-off switch
- C. Blade guard
- D. Blade
- E. Conveyor cart
- F. Water pan
- G. Hand wheel

(NOTE: The hand wheel adjusts the height of the blade.)

- H. Pressure pedal
- I. Water pump

IV. Types of cutting blades (Transparency 3)

(NOTE: There are fast-cutting, standard, and long-life blades for each type of blade. See manufacturer's recommendations of the proper type of blade for various cuttings. The type of blade used will depend on the hardness of the material being cut.)

- A. Wet
- B. Dry
- C. Combination

V. Types of scaffolds (Transparency 4)

- A. Swing stage
- B. Tower adjustable
- C. Tubular

VI. Power tools and specific job use

- A. Masonry table saw--Cut masonry units
- B. Skill saw

- 1. Remove mortar bed joints

INFORMATION SHEET

2. Cut raggle

(NOTE: *Raggle* is a slot cut into a bed joint for the purpose of installing flashing.)

- C. Power hammer

1. Chip
2. Cut holes in masonry walls

- D. Hammer drill--Drill holes in wall

- E. Sheetrock screwdriver--Attach metal ties

VII. Care of masonry table saw

- A. Keep dust removed from saw

(NOTE: This is particularly important during dry cutting.)

- B. Keep table free of debris from block and brick
- C. Keep parts lubricated
- D. Keep water reservoir free of debris
- E. Clean water reservoir and pump daily
- F. Check table wheels weekly for abnormal wear

VIII. Safety rules for operating masonry table saw

- A. Keep work area clean and dry
- B. Keep hands and fingers away from blade
- C. Wear goggles when operating or observing
- D. Wear rubber gloves and apron during wet cutting
- E. Wear dust mask when dry cutting
- F. Inspect blade for damage before mounting it on the saw
- G. Inspect bladeshaft collars and arbor for damage before installing blade
- H. Tighten nut on blade shaft just tight enough to hold blade without slipping; do not overtighten

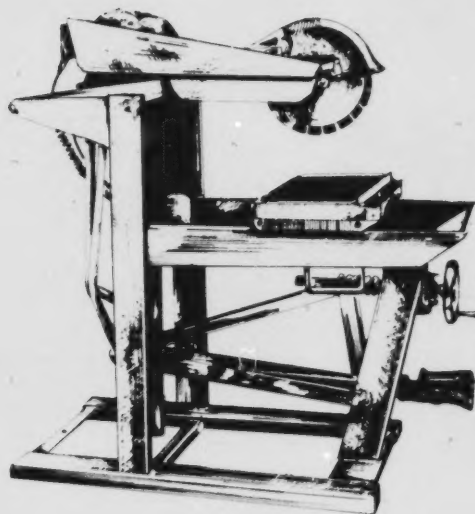
INFORMATION SHEET

- I. Operate blade within specific maximum operating speed
- J. Stand to the outside of blade path when starting saw
- K. Hold materials securely when making cuts

Types of Power Tools



Sheetrock
Screwdriver



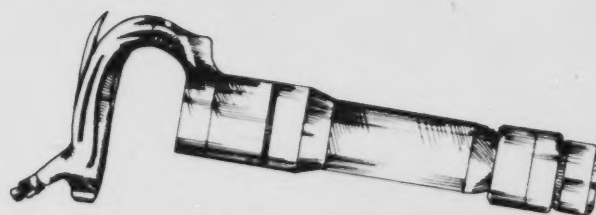
Masonry Table Saw



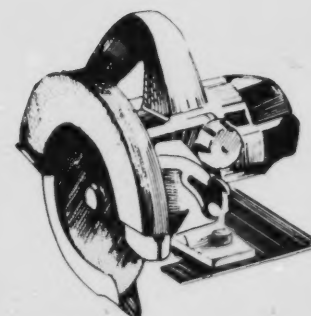
Hammer Drill



Pneumatic
Caulking Gun

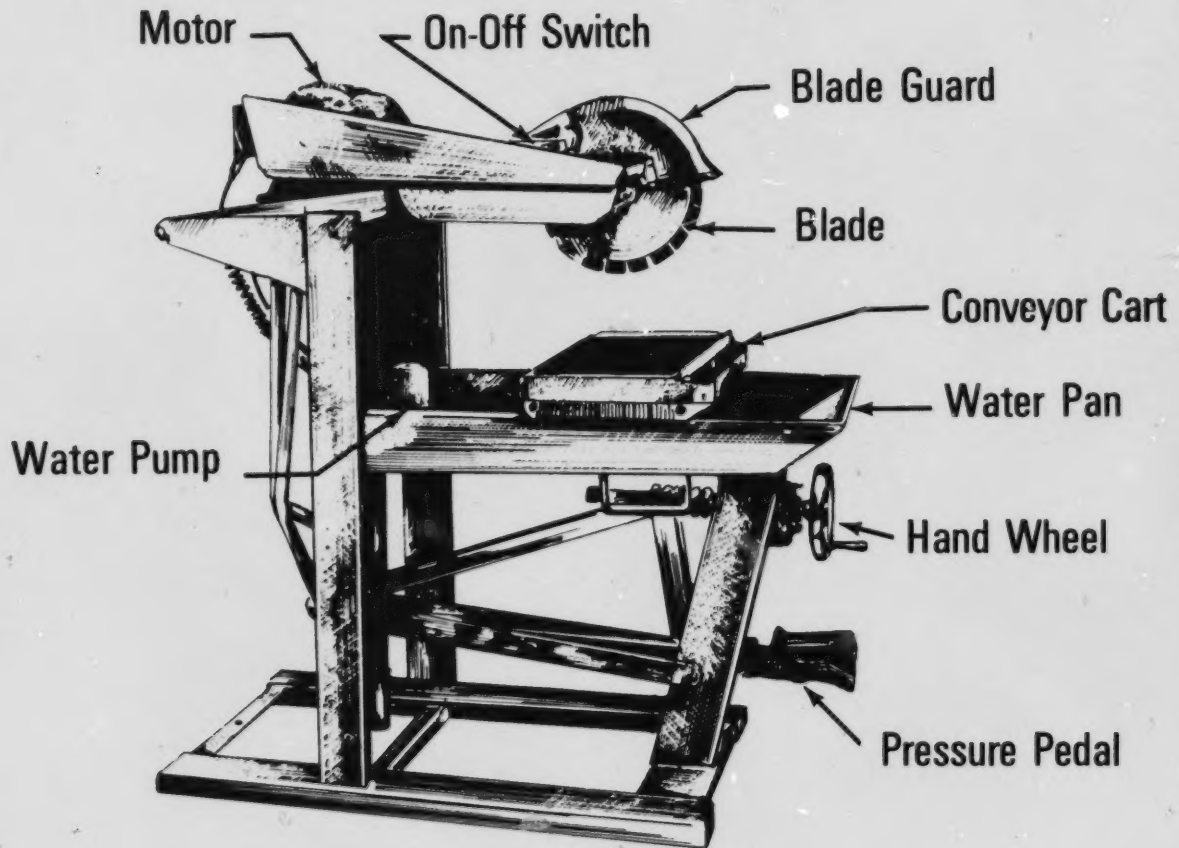


Power Hammer

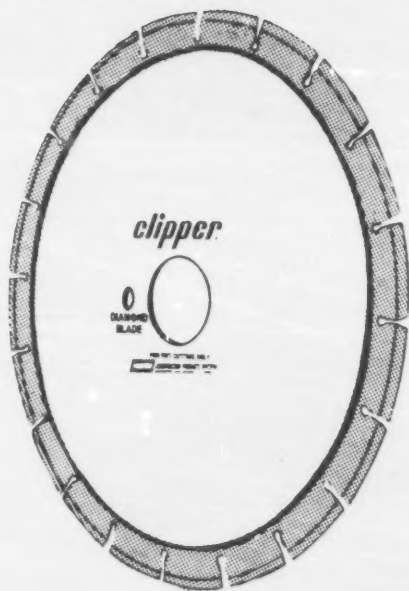


Skill Saw

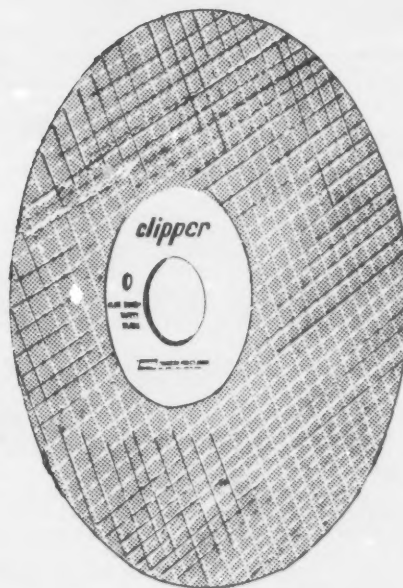
Parts of a Masonry Table Saw



Types of Cutting Blades

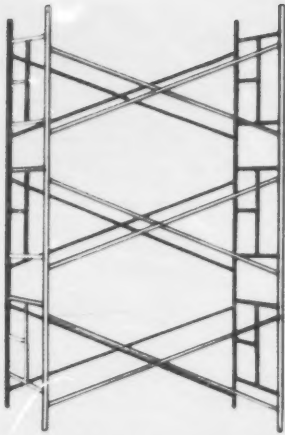


Diamond Blade for Wet Cutting

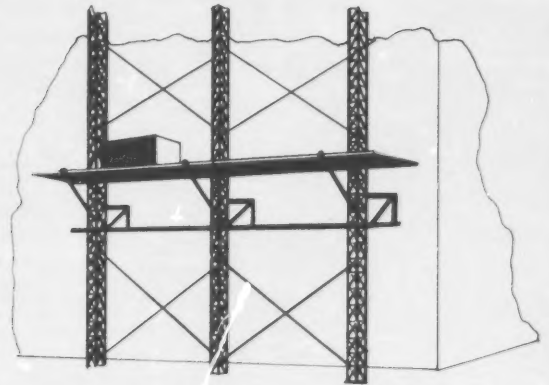


Dry Cutting Blade

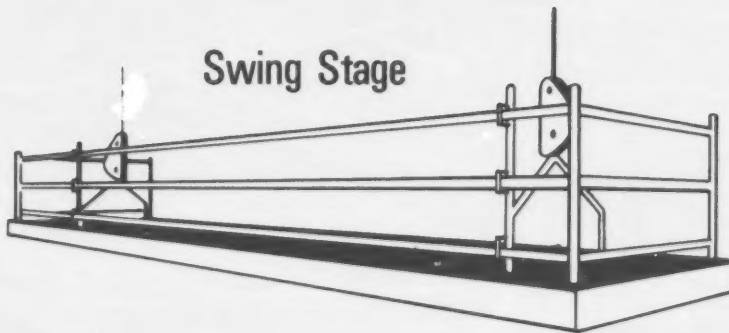
Types of Scaffolds



Tubular



Tower Adjustable



Swing Stage

POWER TOOLS
UNIT II

JOB SHEET #1--CUT MASONRY UNITS USING MASONRY TABLE SAW
WITH ABRASIVE BLADE

- I. Equipment and materials
 - A. Masonry table saw
 - B. Safety glasses
 - C. Rubber gloves (wet cutting)
 - D. Rubber apron (wet cutting)
 - E. Water pump (wet cutting)
 - F. Water curtain (wet cutting)
 - G. Filled water pan or barrel full of water
 - H. Hard dense brick
 - I. Soft brick
 - J. Concrete block
 - K. Lightweight block
 - L. Structural tile
 - M. Exhaust fan (if dry cutting inside)
 - N. Steel square
 - O. Brick hammer
 - P. Marking pencils
 - Q. Abrasive blade for wet cutting hard dense material
 - R. Abrasive blade for wet cutting soft materials
 - S. Abrasive blade for dry cutting hard dense material
 - T. Abrasive blade for dry cutting soft materials
 - U. Wood platform (wet cutting)
 - V. Dust mask

JOB SHEET #1

II. Procedure

A. Mount blade

1. Clean bladeshaft collars and arbors of dirt and all foreign material
2. Mount blade on shaft
3. Tighten blade
4. Rotate blade to see if properly aligned

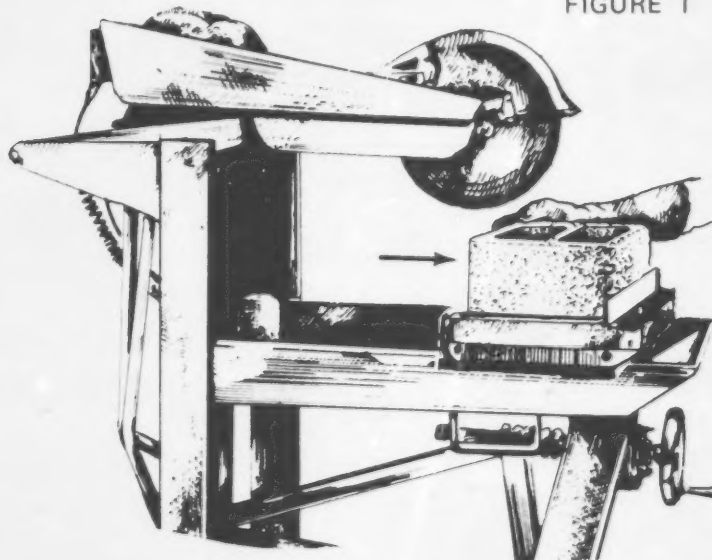
(NOTE: When tightening nut against outside bladeshaft collar, be sure to tighten enough to hold the blade firmly without slipping. Do not overtighten. Excessive tightening can cause fracture of abrasive blades.)

B. Wet cut with abrasive blade

1. Select proper blade
2. Secure material firmly against backstop on conveyor cart (Figure 1)

(CAUTION: Be certain material does not slip or rock during cutting operation. This will bind blades and cause excessive wear and fracture.)

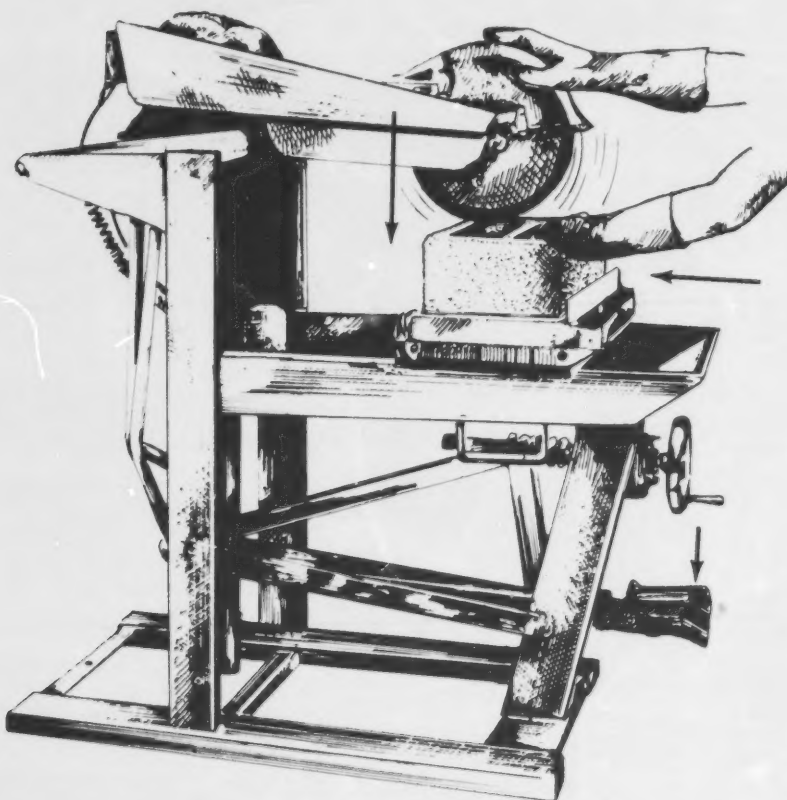
FIGURE 1



JOB SHEET #1

3. Put on safety and protective clothing and equipment
4. Turn on saw and make sure water is being pumped to cool blade
5. Move conveyor cart forward near the blade
6. Push down on the foot pedal until blade is lowered to a point where it will lightly contact top of the material (Figure 2)

FIGURE 2

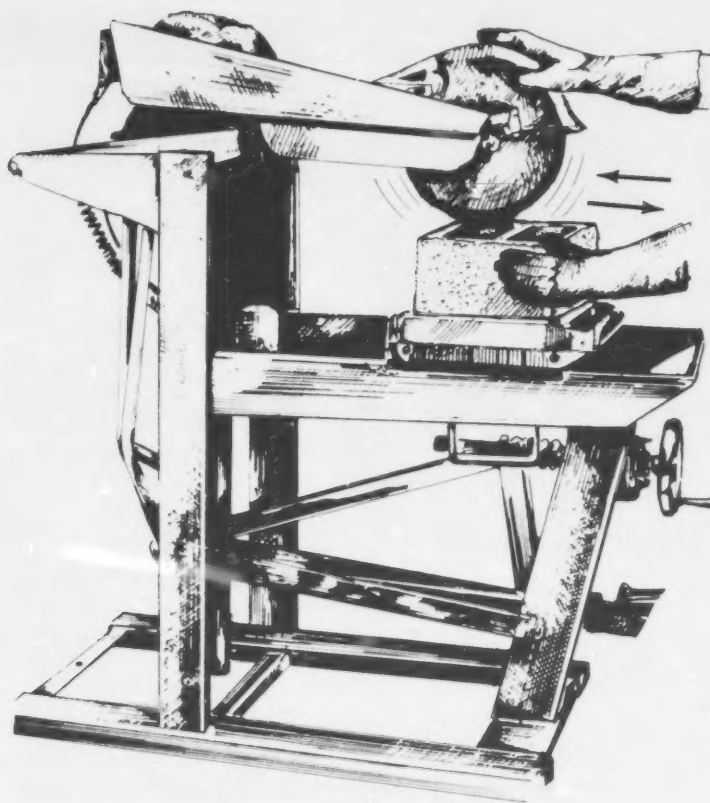


JOB SHEET #1

7. Start "step" cutting (Figure 3)

(NOTE: This means the material is passed beneath the blade with rapid, full-length strokes, approximately 50 to 60 strokes per minute. "Step" cutting should be used without exception when cutting wet or dry with abrasive blades.)

FIGURE 3



8. Make a shallow cut approximately 1/8" deep on the forward stroke and also on the back stroke

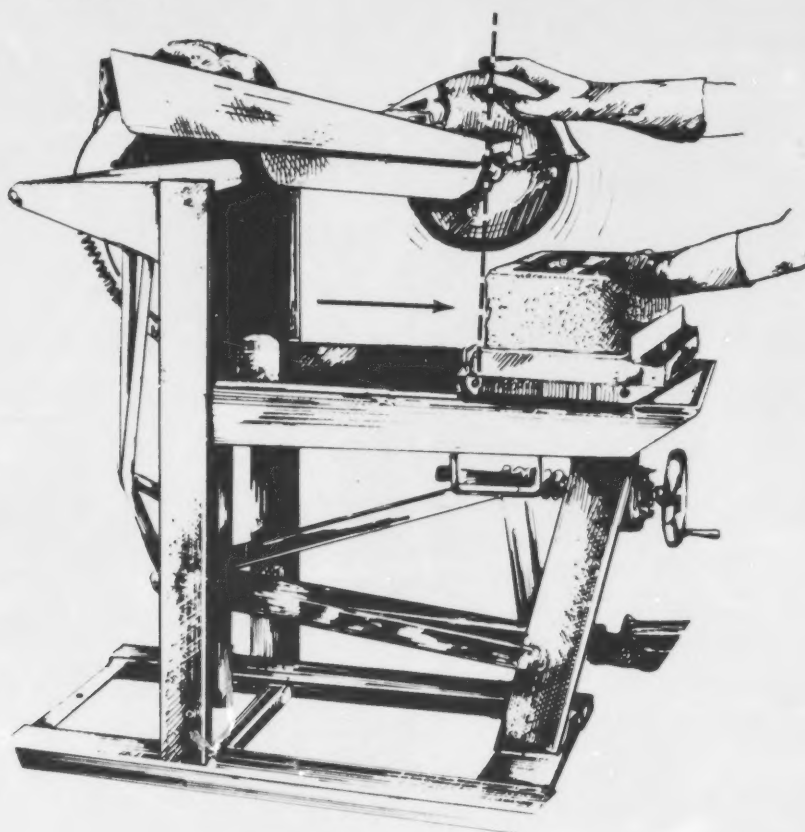
(NOTE: Keep the work area clean when cutting.)

JOB SHEET #1

9. Complete each rapid stroke, forward and backward, by passing the material beyond the center of the blade before starting the reverse movement of the cart (Figure 4)

(CAUTION: The harder the material is, the more rapid the forward and backward strokes should be.)

FIGURE 4



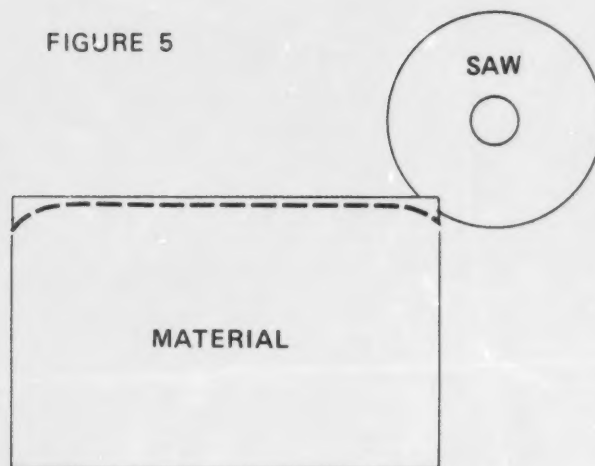
(NOTE: "Step" cutting lessens the area of the blade circumference in contact with the material, keeping the blade cool, running free, and cutting six times faster than trying to force the cut by strong-arming the material through the blade. Forcing the blade through with deep cuts causes a longer area of the blade circumference to be in contact with the material; therefore excessive friction heat is generated and the blade is dulled.)

JOB SHEET #1

10. Complete cut

(NOTE: Cut will be slightly higher in the center and lower on each end. See Figure 5. With the cuts slightly lower at each end, masonry particles are freely and cleanly ejected from the cut and there is free access of air and water into the cut to keep the blade cool and at peak efficiency.)

FIGURE 5



Cut Indicated by Broken Line

C. Dry cut with abrasive blade

1. Select proper blade
2. Remove water curtain
3. Disconnect the electric water pump
4. Use same procedures as described in wet cutting

POWER TOOLS
UNIT II

JOB SHEET #2--CUT MASONRY UNITS USING MASONRY TABLE SAW
WITH DIAMOND BLADE

I. Equipment and materials

- A. Masonry table saw with water pump and supply
- B. Diamond blade
- C. Masonry units
- D. Rubber gloves
- E. Rubber apron
- F. Safety glasses
- G. Water curtain
- H. Steel square
- I. Brick hammer
- J. Marking pencils
- K. Wood platform

JOB SHEET #2

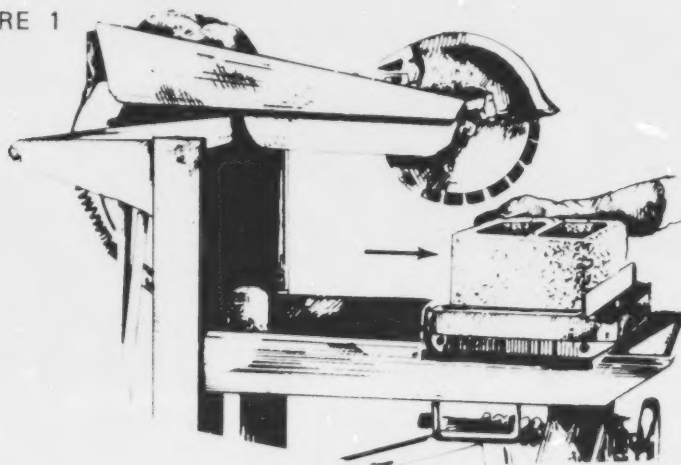
II. Procedure

A. Force cut

1. Secure cutting head in a fixed position
2. Secure the masonry unit to the conveyor cart backstop (Figure 1)

(CAUTION: If the material is allowed to slip, seizure of the blade may bend the diamond blade center or cause a rim section to be twisted off.)

FIGURE 1



(NOTE: When wet cutting, water may be supplied by either filling the water pan to within 1/2" of top or by placing a barrel of clean water next to saw. Using water from the water pan will result in using the same water continuously, while using water from a barrel will result in using clean water continuously. To use the water in a barrel, remove pump from water pan and submerge it in the water barrel. Remove the drain plug from water pan so used water and sludge will drain from pan.)

3. Put on the safety and protective clothing and equipment
4. Turn on saw

(NOTE: Make sure water pump is pumping an ample supply of water to cool blade.)

5. Push conveyor cart to blade until blade comes in contact with masonry unit

(CAUTION: Do not force or bump material into blade.)

JOB SHEET #2

6. Apply a constant pressure to cart as blade starts to make cut

(NOTE: Only one cut will be made through the masonry unit.)

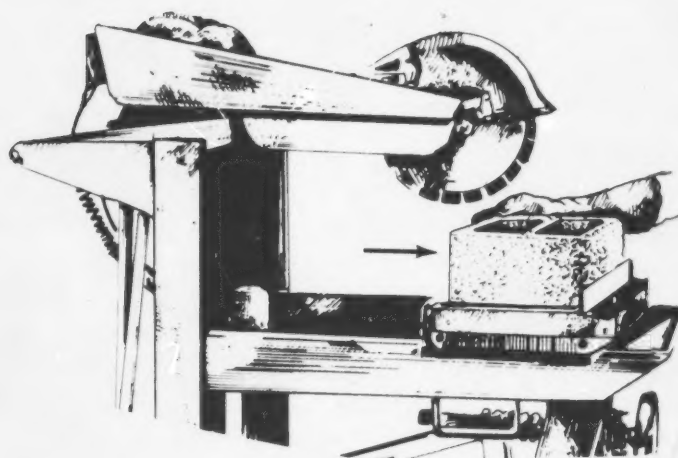
7. Retard the pressure and hold back slightly on the cart as you near completion of the cut

(NOTE: If a constant pressure is held on the cart, the material may be pulled into the blade so fast that excessive pressure on the rim may cause warping or twisting of the rim section.)

B. "Step" cut

1. Secure the masonry unit to the conveyor cart backstop (Figure 2)

FIGURE 2

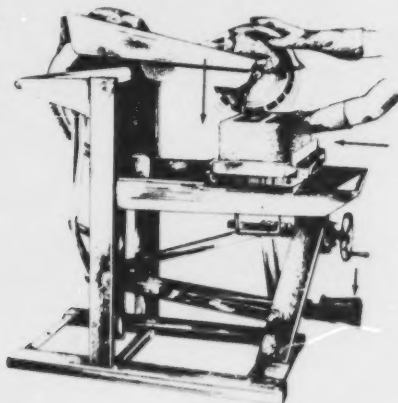


2. Put on safety and protective clothing and equipment
3. Turn on saw
4. Check to see if water supply is ample
5. Move conveyor cart forward the blade

JOB SHEET #2

6. Push down on the foot pedal until blade is lowered to the point where it will lightly contact top of material (Figure 3)

FIGURE 3



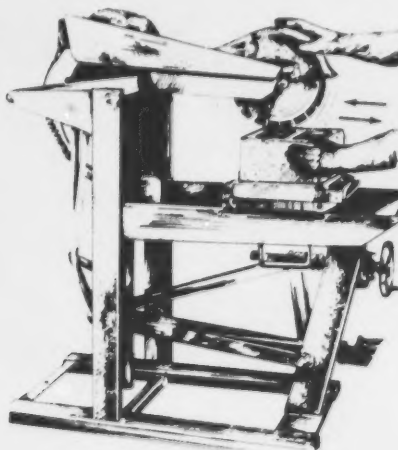
7. Start "step" cutting by moving the material beneath the blade with rapid, full-length strokes

(NOTE: "Step" cutting with a diamond blade requires fewer strokes than with an abrasive blade.)

8. Complete each rapid stroke, forward and backward, by passing the material beyond the center of the blade before starting the reverse movement of the cart (Figure 4)

(NOTE: Keep the work area clean of material.)

FIGURE 4



(NOTE: At end of day, remove diamond blade from saw. It is too expensive to leave on the construction site.)

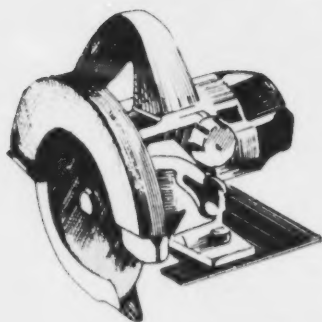
POWER TOOLS
UNIT II

TEST

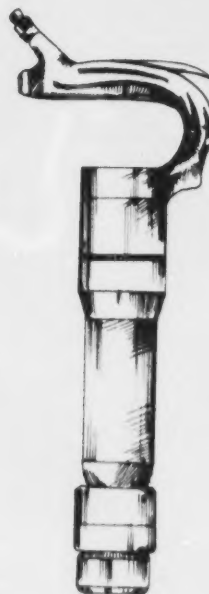
1. Match the terms on the right to the correct definitions.

- | | |
|---|---------------------------|
| _____ a. Air-driven gun used for placing a caulking substance around window and door openings | 1. Hammer drill |
| _____ b. Equipment used by the bricklayer in cleaning masonry walls | 2. Masonry table saw |
| _____ c. Power-driven table saw used for cutting masonry units | 3. Pressure cleaner |
| _____ d. Air-driven hammer used for chipping and cutting masonry holes | 4. Skill saw |
| _____ e. Temporary structure or platform used to support workmen and materials at each staging height during construction | 5. Pneumatic caulking gun |
| _____ f. Power-driven tool used for removing mortar bed joints and cutting raggles | 6. Power hammer |
| _____ g. Tool used for drilling holes | 7. Scaffold |
| _____ h. Tool used for attaching metal ties | 8. Sheetrock screwdriver |

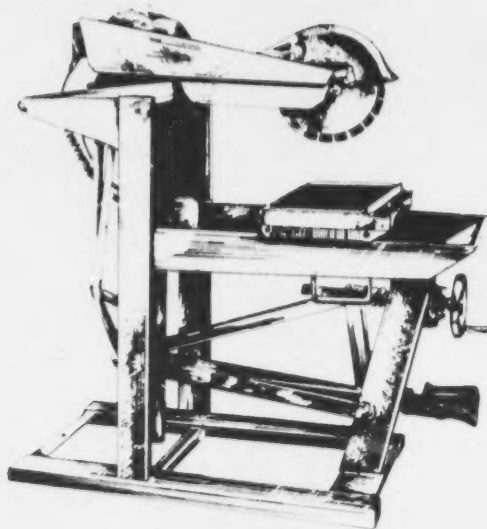
2. Identify the power tools shown below by writing the correct names in the blanks provided.



a. _____



b. _____

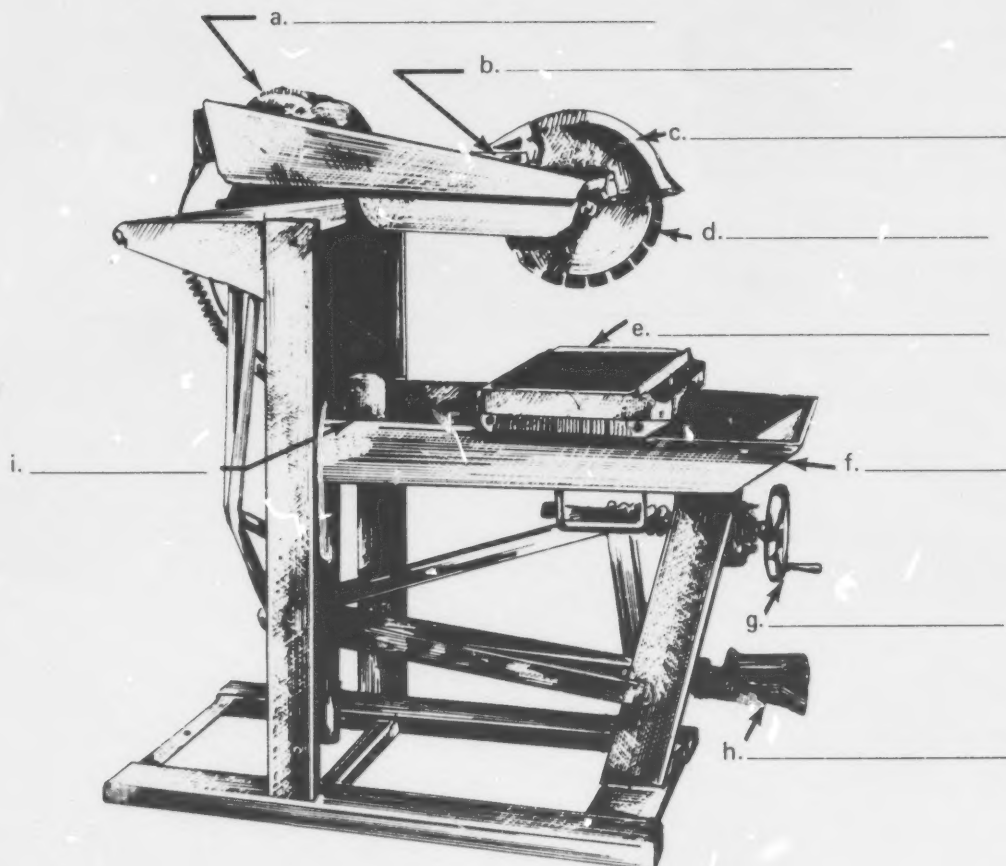


c. _____



d. _____

3. Identify the parts of the masonry table saw shown below by writing the correct names in the blanks provided.



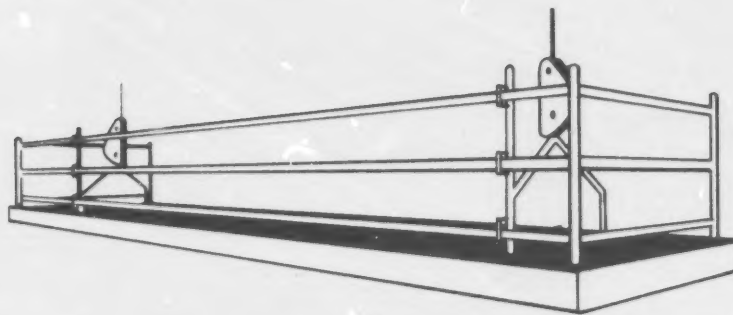
4. Name the three types of cutting blades used on a masonry table saw.

a.

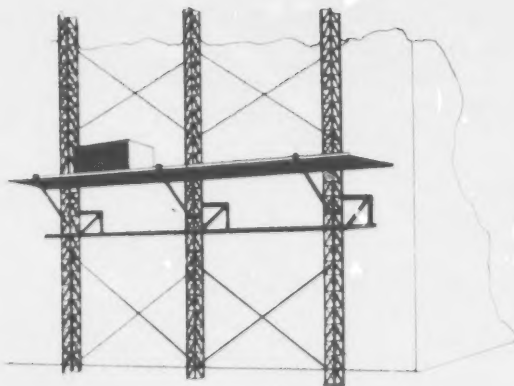
b.

c.

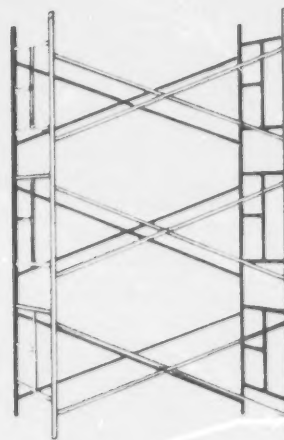
5. Identify the following three types of scaffolds.



a. _____



b. _____



c. _____

6. Match the types of tools on the right to the specific job use by placing the appropriate number in the blanks provided. (Some answers may be used more than once.)

_____ a. Cut masonry units	1. Power hammer
_____ b. Cut raggle	2. Masonry table saw
_____ c. Cut holes in masonry walls	3. Hammer drill
_____ d. Drill holes in wall	4. Skill saw
_____ e. Chip	5. Sheetrock screwdriver
_____ f. Remove mortar bed joints	
_____ g. Attach metal ties	

7. Name three factors to consider in caring for the masonry table saw.

a.
b.
c.

8. Name three safety rules to follow when operating a masonry table saw.

a.
b.
c.

9. Demonstrate the ability to:

- a. Cut masonry units using a masonry table saw with an abrasive blade.
b. Cut masonry units using a masonry table saw with a diamond blade.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

POWER TOOLS
UNIT II

ANSWERS TO TEST

- | | | | | | | |
|----|----|---|----|---|----|---|
| 1. | a. | 5 | d. | 6 | g. | 1 |
| | b. | 3 | e. | 7 | h. | 8 |
| | c. | 2 | f. | 4 | | |
- 2.
- a. Skill saw
 - b. Power hammer
 - c. Masonry table saw
 - d. Sheetrock screwdriver
- 3.
- a. Motor
 - b. On-off switch
 - c. Blade guard
 - d. Blade
 - e. Conveyor cart
 - f. Water pan
 - g. Hand wheel
 - h. Pressure pedal
 - i. Water pump
- 4.
- a. Wet
 - b. Dry
 - c. Combination
- 5.
- a. Swing stage
 - b. Tower adjustable
 - c. Tubular

6.

a. 2	e. 1
b. 4	f. 4
c. 1	g. 5
d. 3	
7. Any three of the following:
 - a. Keep dust removed from saw
 - b. Keep table free of debris from block and brick
 - c. Keep parts lubricated
 - d. Keep water reservoir free of debris
 - e. Clean water reservoir and pump daily
 - f. Check table wheels weekly for abnormal wear
8. Any three of the following:
 - a. Keep work area clean and dry
 - b. Keep hands and fingers away from blade
 - c. Wear goggles when operating or observing
 - d. Wear rubber gloves and apron during wet cutting
 - e. Wear dust mask when dry cutting
 - f. Inspect blade for damage before mounting it on the saw
 - g. Inspect bladeshaft collars and arbor for damage before installing blade
 - h. Tighten nut on blade shaft just tight enough to hold blade without slipping; do not overtighten
 - i. Operate blade within specific maximum operating speed
 - j. Stand to the outside of blade path when starting saw
 - k. Hold materials securely when making cuts
9. Performance skills evaluated to the satisfaction of the instructor

RELATED EQUIPMENT UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify related equipment that the bricklayer will find on some jobs and match related equipment to specific job use. The student will be able to identify hand signals used in moving heavy equipment and materials. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with related equipment to the correct definitions.
2. Identify related equipment that the bricklayer will find on some jobs.
3. Match related equipment to the specific job use.
4. Identify hand signals used in moving equipment and materials.

RELATED EQUIPMENT UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Show examples of equipment and demonstrate proper use.
- G. Demonstrate the use of hand signals.
- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 1. TM 1--Related Equipment
 2. TM 2--Related Equipment (Continued)
 3. TM 3--Hand Signals
 4. TM 4--Hand Signals (Continued)
 5. TM 5--Hand Signals (Continued)

D. Test

E. Answers to test

II. References:

- A. Hendrix, Laborn, and Patton, Bob. *Cement-Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center, 1975.
- B. Toennies, Henry, and Merten, John E. *Concrete Masonry Vocational Training*. McLean, Virginia: National Concrete Masonry Association, 1973.
- C. Henegar, Wayne. *A Curriculum Guide for Heavy Equipment Operation and Maintenance*. Springfield: Illinois Office of Education/Department of Adult Vocational and Technical Education, 1976.

RELATED EQUIPMENT
UNIT III

INFORMATION SHEET

I. Terms and definitions (Transparencies 1 and 2)

- A. Conveyor--Equipment used for carrying materials from ground level to a scaffold

(NOTE: It can also be used for transporting materials to the center of the building through door and window openings.)

- B. Mortar mixer--Machine used for mixing mortar

- C. Forklift--Motorized equipment used for lifting and moving materials

(NOTE: It is also used for placing materials on a scaffold.)

- D. Crane--Equipment used for lifting heavy materials from low elevations to high elevations

(NOTE: It is also used for placing materials on a scaffold.)

- E. Hoist--Equipment used for moving materials from low to high elevations

(NOTE: The hoist is also called a *personnel hoist* or *construction elevator*.)

- F. Power buggy--Equipment used for moving materials

(NOTE: The power buggy is usually used on flat surfaces.)

- G. Mortar board or tub--Equipment used for storing mortar

- H. Brick tongs--Tool used by laborer or bricklayer's tender to carry and store brick

II. Types of related equipment (Transparencies 1 and 2)

- A. Mortar mixer
B. Forklift
C. Crane
D. Hoist
E. Conveyor

INFORMATION SHEET

- F. Power buggy
- G. Mortar board or tub
- H. Brick tongs
- I. Tower crane

III. Uses of related equipment

- A. Mortar mixer--Mix mortar
- B. Forklift

- 1. Lift and transport masonry units
- 2. Transport mortar
- 3. Place material on a scaffold

C. Crane

- 1. Lift and transport brick, block, mortar, and large masonry units at heights greater than 12 feet
- 2. Set panels in place

(NOTE: A crane is generally used only on very large construction jobs.)

- D. Tower crane--Lift and transport construction material to various levels of a very large building

(NOTE: Tower cranes sit in the center of the building and are used to transport materials to a height greater than can be reached by a mobile crane.)

- E. Hoist--Transport materials from the ground floor to upper floors on multi-story buildings

(NOTE: A hoist or construction elevator is generally used only on very large construction jobs.)

F. Conveyor

- 1. Place materials on scaffold
- 2. Transport materials through window and door openings

- G. Power buggy--Transport materials such as brick, block, and mortar

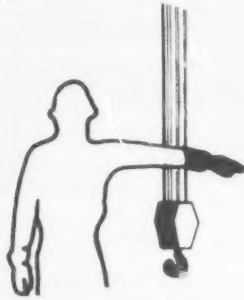
INFORMATION SHEET

H. Mortar board or tub--Store mortar while bricklayer is laying a course of brick or building a wall

I. Brick tongs--Carry and store brick on a scaffold

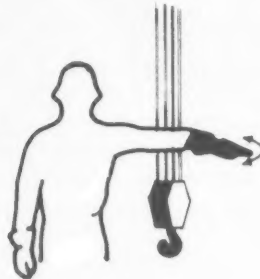
IV. Hand signals (Transparencies 3, 4, and 5)

A. Stop



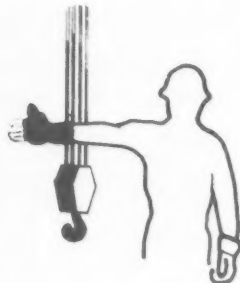
(NOTE: Extend arm with palm of hand down. Hold position rigidly.)

B. Emergency stop



(NOTE: Extend arm with palm of hand down. Move hand rapidly right and left.)

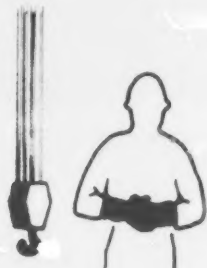
C. Raise boom/lower load



(NOTE: Extend arm with thumb pointing up. Flex fingers in and out as long as load movement is desired.)

INFORMATION SHEET

D. Dog everything



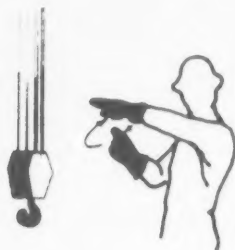
(NOTE: Clasp hands in front of body.)

E. Hoist



(NOTE: Hold forearm vertically, pointing forefinger up. Move hand in small horizontal circle.)

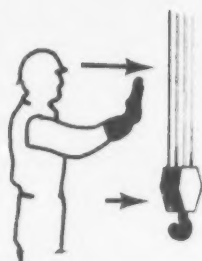
F. Move slowly



(NOTE: Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal.)

INFORMATION SHEET

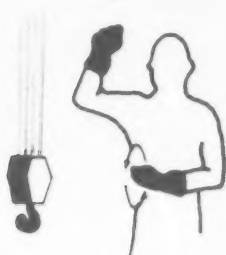
G. Travel



(NOTE: Extend arm forward with hand open and slightly raised. Make a pushing motion in the direction of travel.)

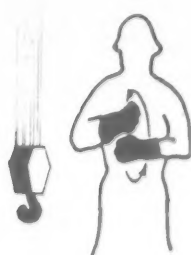
H. Crane travel

1. One track



(NOTE: Raise fist to indicate which track is to be locked. Rotate the other fist in a circular motion vertically in front of the body to indicate direction of travel in the opposite track. This is used for crawler cranes only.)

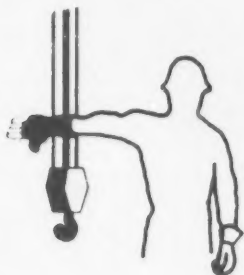
2. Both tracks



(NOTE: Place both fists in front of the body and make a circular motion about each other to indicate direction of travel either forward or backward. This is used for crawler cranes only.)

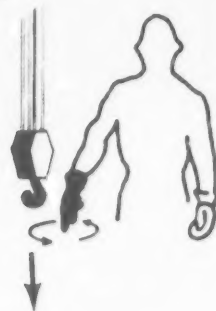
INFORMATION SHEET

I. Lower boom/raise load



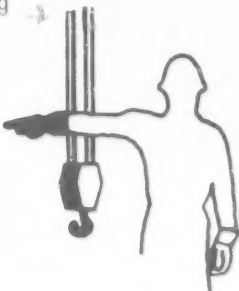
(NOTE: Extend arm with thumb pointing down. Flex fingers in and out as long as load movement is desired.)

J. Lower



(NOTE: Extend arm downward with forefinger pointing down. Move hand in small horizontal circles.)

K. Swing



(NOTE: Extend arm and point finger in direction of swing of boom.)

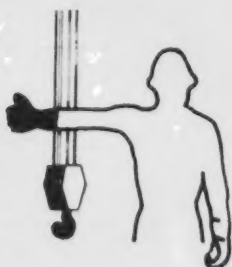
INFORMATION SHEET

L. Use main hoist



(NOTE: Tap fist on head; then use regular signals.)

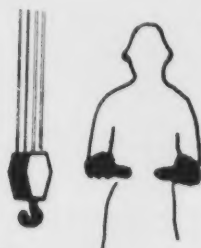
M. Raise boom



(NOTE: Extend arm, close fingers, and point thumb upward.)

N. Retract boom (telescoping booms)

1.



(NOTE: Hold both fists in front of body with thumbs pointing toward each other.)

INFORMATION SHEET

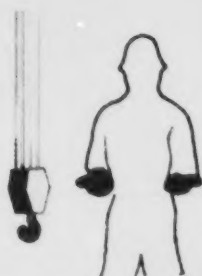
2.



(NOTE: Hold one fist in front of chest with thumb pointing outward and heel of fist tapping chest.)

O. Extend boom (telescoping booms)

1.



(NOTE: Hold both fists in front of body with thumbs pointing outward.)

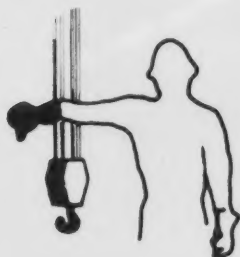
2.



(NOTE: Hold one fist in front of chest with thumb tapping chest.)

INFORMATION SHEET

P. Lower boom



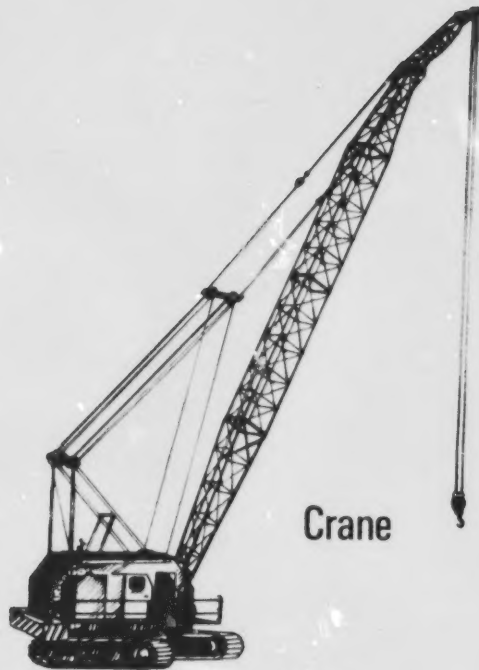
(NOTE: Extend arm, close fingers, and point thumb downward.)

Q. Use whip line (auxiliary hoist)

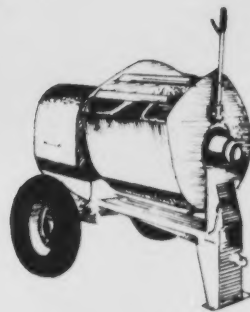


(NOTE: Tap elbow with one hand; then use regular signals.)

Related Equipment



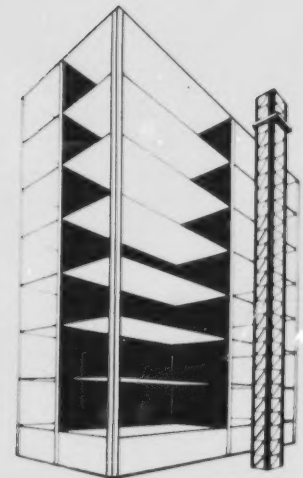
Crane



Mortar Mixer



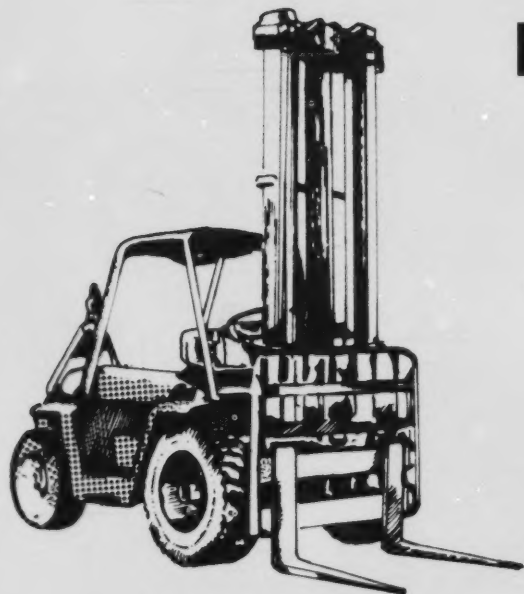
Conveyor



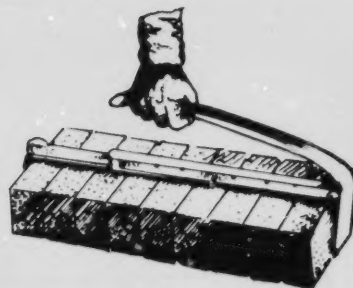
Hoist

Related Equipment

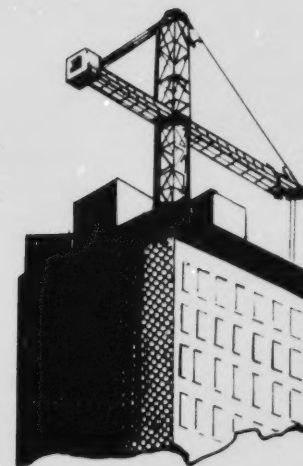
(Continued)



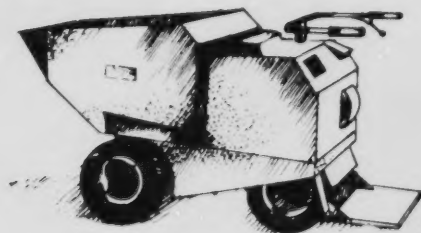
Forklift



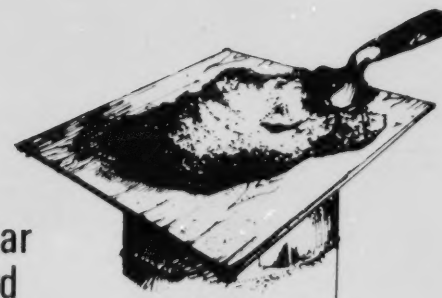
Brick Tongs



Tower Crane

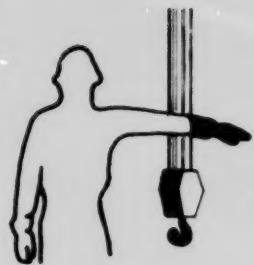


Power Buggy



Mortar Board

Hand Signals



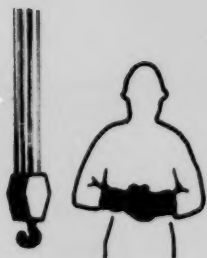
Stop



Emergency Stop



Raise Boom/Lower Load



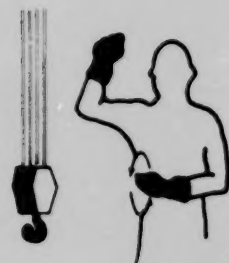
Dog Everything



Hoist



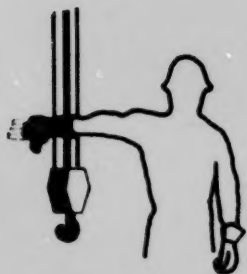
Move Slowly



Crane Travel
(one track)

Hand Signals

(Continued)



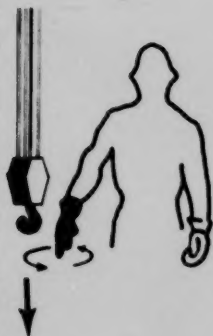
Lower Boom/Raise Load



Crane Travel (both tracks)



Travel



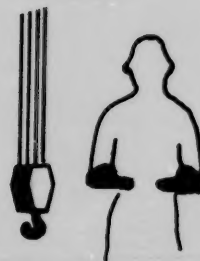
Lower



Swing



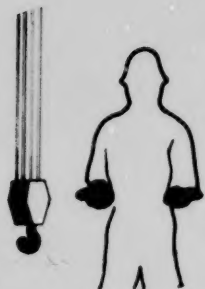
Use Main Hoist



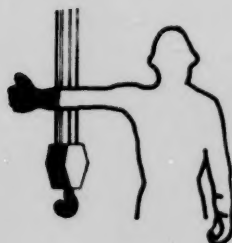
Retract Boom

Hand Signals

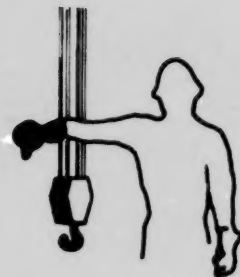
(Continued)



Extend Boom



Raise Boom



Lower Boom



Retract Boom



Extend Boom



Use Whip Line

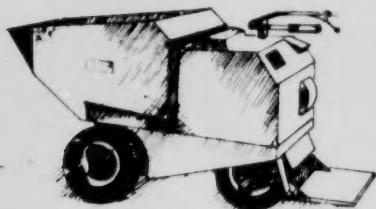
RELATED EQUIPMENT UNIT III

TEST

1. Match the terms on the right to the correct definitions.

- | | |
|--|------------------------|
| _____ a. Equipment used for carrying materials from ground level to a scaffold | 1. Power buggy |
| _____ b. Machine used for mixing mortar | 2. Hoist |
| _____ c. Motorized equipment used for lifting and moving materials | 3. Mortar board or tub |
| _____ d. Equipment used for lifting heavy materials from low elevations to high elevations | 4. Forklift |
| _____ e. Equipment used for moving materials from low to high elevations | 5. Conveyor |
| _____ f. Equipment used for moving materials | 6. Brick tongs |
| _____ g. Equipment used for storing mortar | 7. Mortar mixer |
| _____ h. Tool used by laborer or bricklayer's tender to carry and store brick | 8. Crane |

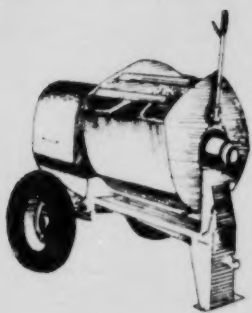
2. Identify the following related equipment by placing the correct names in the blanks provided.



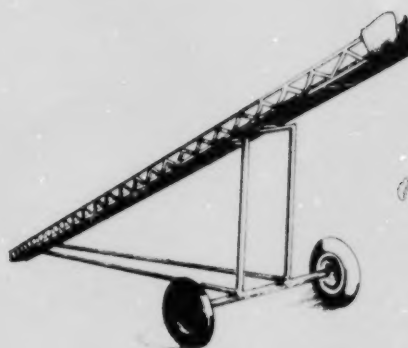
a. _____



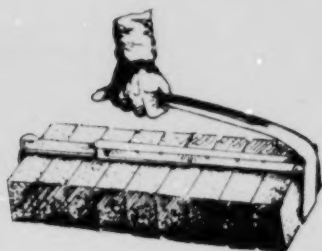
b. _____



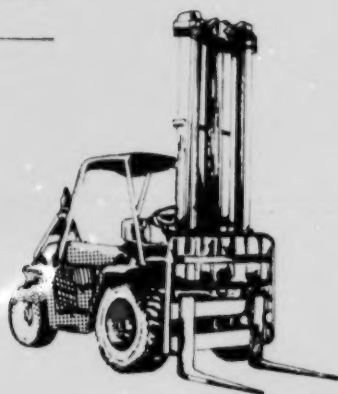
c. _____



d. _____



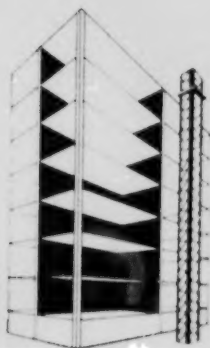
e. _____



h. _____



f. _____



g. _____

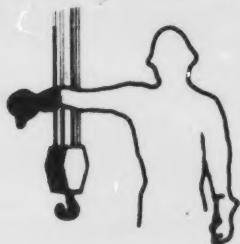


i. _____

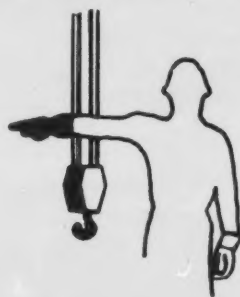
3. Match the related equipment on the right to the specific job use.

- | | |
|--|------------------------|
| _____ a. Place materials on scaffold; transport material; through window and door openings | 1. Mortar mixer |
| _____ b. Store mortar while bricklayer is laying a course of brick or building a wall | 2. Forklift |
| _____ c. Lift and transport construction material to various levels of a very large building | 3. Crane |
| _____ d. Transport materials such as brick, block, and mortar | 4. Hoist |
| _____ e. Lift and transport masonry units; transport mortar; place material on a scaffold | 5. Conveyor |
| _____ f. Transport materials from the ground floor to upper floors on multi-story buildings | 6. Power buggy |
| _____ g. Mix mortar | 7. Mortar board or tub |
| _____ h. Carry and store brick on a scaffold | 8. Brick tongs |
| _____ i. Lift and transport brick, block, mortar, and large masonry units at heights greater than 12 feet; set panels in place | 9. Tower crane |

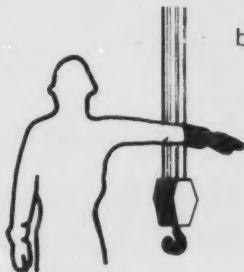
4. Identify the hand signals below and on the following page.



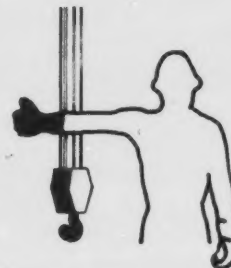
a. _____



b. _____



c. _____



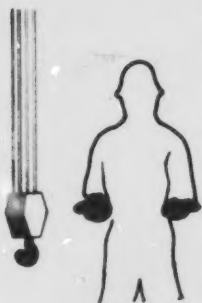
d. _____



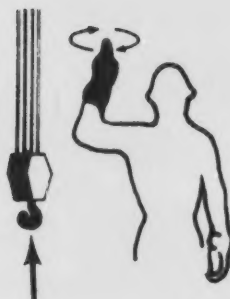
e. _____



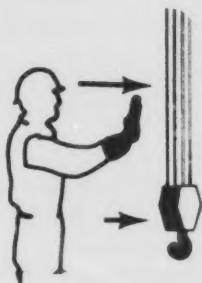
f. _____



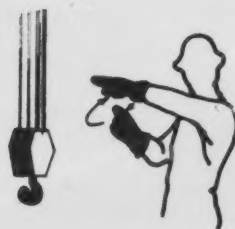
g. _____



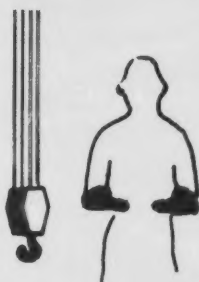
h. _____



i. _____



j. _____



k. _____

RELATED EQUIPMENT
UNIT III

ANSWERS TO TEST

1.

a. 5	e. 2
b. 7	f. 1
c. 4	g. 3
d. 8	h. 6
2.

a. Power buggy	
b. Mortar board	
c. Mortar mixer	
d. Conveyor	
e. Brick tongs	
f. Tower crane	
g. Hoist	
h. Forklift	
i. Crane	
3.

a. 5	f. 4
b. 7	g. 1
c. 9	h. 8
d. 6	i. 3
e. 2	
4.

a. Lower boom/raise load	g. Extend boom
b. Swing	h. Hoist
c. Stop	i. Travel
d. Raise boom/lower load	j. Move slowly
e. Emergency stop	k. Retract boom
f. Lower	

Student's Name _____

[illegible]

BRICKLAYING PROGRESS CHART

Section B Tools and Equipment

Student's Name

Job
Unit Test

Unit Test
Cut Masonry Units Using Masonry
Table Saw with Abrasive Blade
Cut Masonry Units Using Masonry
Table Saw with Diamond Blade
Unit Test

Unit I
Hand Tools

Unit II
Power Tools

Unit III
Related
Equipment

1

1

2

3

1

1

2

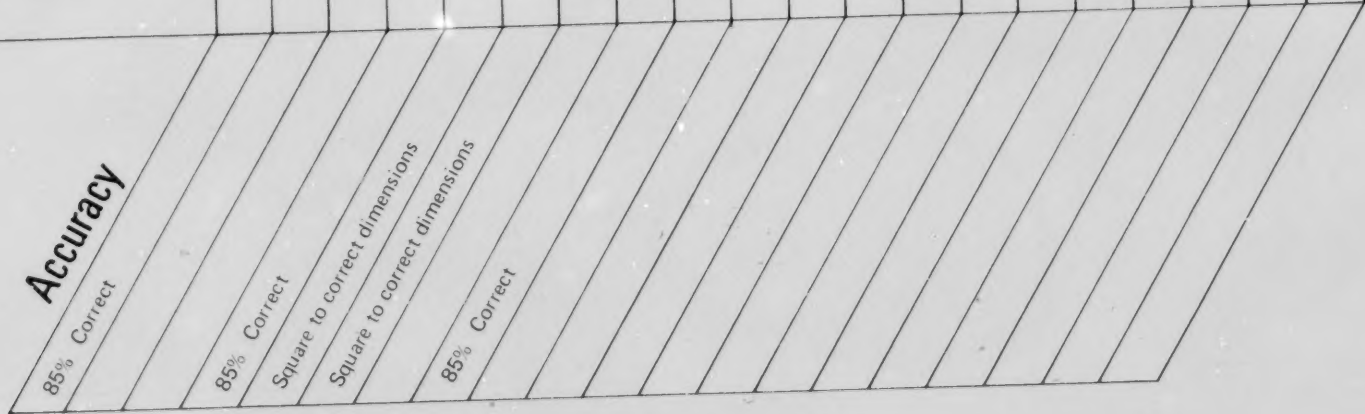
3

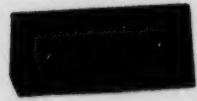
4

5

6

10
11
12
13
14
15
16
17
18
19
20





PERSONAL AND JOB SAFETY
UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list rules for personal and general safety and describe types of clothing to wear on the job. The student should be able to complete a safety checklist and sign the safety pledge form. This knowledge will be evidenced by scoring one hundred percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with personal and job safety to the correct definitions.
2. Describe types of clothing a person should wear on the job.
3. List rules for personal safety.
4. List rules for general job safety.
5. List methods used to maintain a clean and orderly work area.
6. Identify correct way to lift heavy objects.
7. Complete a safety checklist.
8. Complete a safety pledge form.

PERSONAL AND JOB SAFETY
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Make transparency.
- D. Discuss terminal and specific objectives.
- E. Discuss information and assignment sheets.

(NOTE: Instructor may want to contact a safety engineer to be a resource person for the class concerning safety on the job. Instructor may also want student to complete a first aid course and to be certified according to OSHA regulations. Additional copies of the safety checklist may be obtained by writing Milwaukee Construction Industry Safety Council, 2733 West Wisconsin Avenue, Milwaukee, Wisconsin 53208, or calling 414-933-7661.)

- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Complete assignment sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency master: TM 1--Proper way to Lift Heavy Objects

D. Assignment sheets

1. Assignment Sheet #1--Complete a Safety Checklist
2. Assignment Sheet #2--Complete a Safety Pledge

E. Test

F. Answers to test

II. References:

- A. U.S. Department of Health, Education, and Welfare, Office of Education. *An Accident Prevention Program for School Shops and Laboratories*. Department of Vocational Education/Pennsylvania State University, 1967.
- B. Department of Labor. *Federal Register*. Vol. 36, no. 105, pt. 2, 29 May 1971.
- C. Department of Education/Division of Vocational Education. *Safety Practices and Procedures in School Shops*. Trenton: New Jersey State Department of Vocational Education.
- D. *Manual of Accident Prevention in Construction*. The Associated General Contractors of America, 1971.
- E. Diehl, Donald W., and Penner, Wayman R. *Commercial Carpentry*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1974.
- F. Hendrix, Laborn J., and Patton, Bob. *Cement Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1975.

PERSONAL AND JOB SAFETY
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Safety--State or condition of being safe; freedom from danger, risk, or injury
- B. Accident--Any suddenly occurring, unintentional event which causes injury or property damage
- C. First aid--Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained
- D. Hazard--Source of danger
- E. Carelessness--Condition of being unsafe

(NOTE: The major cause of accidents is carelessness.)

F. OSHA--Occupational Safety and Health Act

II. Types of clothing to wear on the job

(NOTE: Wear clothing appropriate to the situation.)

- A. Pants and shirt should be snug fitting but allow for freedom of movement
- B. Hard hat should be worn at all times
- C. Safety shoes must be worn to protect the feet
- D. Goggles and dust mask should be worn when working in a dangerous area

III. Personal safety rules

- A. Wear clothing appropriate to the instructional activity being performed
- B. Confine long hair before operating rotating equipment
- C. Wear safety glasses; use suitable helmets and goggles for cutting, chipping, and grinding
- D. Remove ties when working around machine tools or rotating equipment
- E. Remove rings and other jewelry when working

INFORMATION SHEET

- F. Prevent accidents by working safely
- G. Use soap and water frequently as a method of preventing skin diseases

IV. General safety rules

- A. Keep all hand tools sharp, clean, and in safe working order
- B. Report any defective tools, machines, or other equipment to the supervisor

(NOTE: In this unit, the term *supervisor* refers to the foreman, superintendent, or instructor who is in charge of the work area.)

- C. Retain all guards and safety devices
- D. Operate a hazardous machine only after receiving instruction on how to operate the machine safely
- E. Report all accidents to the supervisor regardless of nature or severity
- F. Have operator turn off power and make certain the machine has stopped running before leaving
- G. Make sure all guards and barriers are in place
- H. Disconnect the power from machine tools before performing the maintenance task of oiling or cleaning
- I. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
- J. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held
- K. Keep the work area clear of scraps and litter
- L. Clean up any spilled liquids immediately
- M. Clean the chips from a machine with a brush, not with a rag or bare hands
- N. Do not use compressed air to clean your person or clothing
- O. Use only approved scaffolding
- P. Use a swing scaffold only after proper instruction and in accordance with OSHA regulations

INFORMATION SHEET

- V. Methods used to maintain a clean and orderly work area
- A. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning
 - B. Stack materials and supplies safely or store in proper place
 - C. Store tools and accessories safely in cabinets, on racks, or in other suitable devices
 - D. Clear working areas and workbenches of debris and other hazards
 - E. Clean and free floors from obstructions and slipping substances
 - F. Free aisles, traffic areas, and exits of materials and other debris
 - G. Know the proper procedures to follow in keeping the work area clean and orderly
 - H. Keep sufficient brooms, brushes, and other housekeeping equipment readily available
- VI. Proper way to lift heavy objects (Transparency 1)
- A. Lift with legs, not with back
 - B. Keep back straight
 - C. Do not lift heavy objects without help

Proper Way to Lift Heavy Objects



This



Not This!

PERSONAL AND JOB SAFETY
UNIT I

ASSIGNMENT SHEET #1--COMPLETE A SAFETY CHECKLIST

Use the following safety inspection checklist to evaluate a construction site.

INSPECTION CHECKLIST

JOB NAME _____ DATE OF INSPECTION _____

JOB NUMBER _____ INSPECTED BY _____

TO AID COMPLIANCE WITH FEDERAL
SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

<u>General Requirements</u>		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1904	Recordkeeping up-to-date.	_____	_____	_____
1904	OSHA poster on the job.	_____	_____	_____
1904.2 (c)	Copy of federal safety and health regulations for construction available on job.	_____	_____	_____
(Subpart C) <u>General Safety and Health Provisions</u>				
1926.20	No employee "to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health or safety."	_____	_____	_____
1926.20 (B) (1)	Accident prevention program initiated and maintained by employer.	_____	_____	_____
1926.20 (B) (2)	Regular and frequent inspection of job sites, materials, and equipment made by competent designated persons.	_____	_____	_____
1926.20 (B) (3)	Procedure established, to identify unsafe tools, materials, or equipment by tagging or by locking controls or removing from use.	_____	_____	_____
1926.20 (B) (4)	Only qualified employees permitted to operate equipment or machinery.	_____	_____	_____
1926.21	Employees instructed in recognition and avoidance of unsafe conditions.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1926.21 (B) (1)(6)	Special instruction given in case of use of poisons, caustics, flammable liquids, gases, toxic materials, or work in confined or enclosed spaces.	_____	_____	_____
1926.25	Housekeeping -- -Work areas, passageways, stairs kept clear, projecting nails removed. -Scrap and debris removed at regular intervals. -Containers provided and used for waste, trash, other refuse, garbage.	_____	_____	_____
(Subpart D)	<u>Occupational Health and Environmental Controls</u>			
1926.50 (A)	Medical personnel available for advice and consultation.	_____	_____	_____
1926.50 (C)	Person with valid certificate in first aid training available in absence of infirmary, clinic, or hospital.	_____	_____	_____
1926.50 (D) (1)(2)	Approved first aid supplies and kit available on job and checked at least weekly.	_____	_____	_____
1926.50 (B)	Provisions made for prompt medical attention in case of serious injury.	_____	_____	_____
1926.50 (E)	Equipment provided for transporting injured or communication system for contacting ambulance service.	_____	_____	_____
1926.50 (F)	Emergency telephone numbers conspicuously posted.	_____	_____	_____
1926.51 (A) (1-4)	Adequate supply of potable (drinking) water provided, clearly marked, common cup prohibited.	_____	_____	_____
1926.51 (C)	Toilets provided for employees on job site (for number see Table D-1).	_____	_____	_____
1926.52	Protection against effects of noise exposure provided through administrative or engineering controls or personal protective equipment (see Table D-2).	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1926.53	Ionizing radiation, (radioactive material or x-ray) protection provided where needed.	_____	_____	_____
1926.54	Non-ionizing radiation (laser equipment) protection provided where needed.	_____	_____	_____
1926.55	Gases, vapors, fumes, dusts, and mists threshold limits observed.	_____	_____	_____
1926.56	Construction areas lighted to minimum illumination requirements (see Table D-3).	_____	_____	_____
1926.57	Harmful dusts, fumes, mists, vapors, or gases controlled or ventilation provided.	_____	_____	_____
(Subpart E)	<u>Personal Protective and Life Saving Equipment</u>			
1926.100	Hard hats worn by everyone in the construction area.	_____	_____	_____
1926.101	Hearing protection (ear) provided where required.	_____	_____	_____
1926.102	Eye and face protection provided where operation of machines present potential eye or face injury.	_____	_____	_____
1926.103	Appropriate respiratory equipment provided and used where required.	_____	_____	_____
1926.104	Safety belts, lifelines, and lanyards provided and used where required.	_____	_____	_____
1926.105	Safety nets provided where other protection is impractical.	_____	_____	_____
(Subpart F)	<u>Fire Protection and Prevention</u>			
1926.150 (A)	Fire protection program developed and followed.	_____	_____	_____
1926.150 (B)	Water supply for firefighting.	_____	_____	_____
1926.150 (C)	Fire extinguishers (water drums, fire hose) provided.	_____	_____	_____
1926.150 (E)	Alarm or telephone system available for use in emergency.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1926.150 - (F)	Fire walls, exit stairs and fire doors given construction priority.	_____	_____	_____
1926.151 -	Sources of ignition controlled.	_____	_____	_____
1926.151 -	Proper storage practices observed for fire prevention.	_____	_____	_____
1926.151 - (A) (3)	No Smoking or Open Flame signs posted and enforced where needed.	_____	_____	_____
1926.152 -	Storage, use, and handling of flammable and combustible liquids in accordance with standards.	_____	_____	_____
1926.153 -	Liquefied petroleum gas, storage, use, and handling in accordance with standards.	_____	_____	_____
1926.154 -	Clearance, proper mounting, ventilation stability for temporary heating devices.	_____	_____	_____
<u>(Subpart G) Signs, Signals, and Barricades</u>				
1926.200 - (B)	Danger signs available and used only where an immediate hazard exists.	_____	_____	_____
1926.200 - (C)	Caution signs available and used only to warn against potential hazards or to caution against unsafe practices.	_____	_____	_____
1926.200 - (D)	Exit signs posted where required	_____	_____	_____
1926.200 - (E) (F)	Safety Instruction and Directional signs posted where required.	_____	_____	_____
1926.200 - (G)	Traffic signs posted where required.	_____	_____	_____
1926.200 - (H)	Accident prevention tags available and used where required.	_____	_____	_____
1926.201 - (A)	Flagmen used where required.	_____	_____	_____
1926.201 - (B)	Crane and hoist signals posted and used.	_____	_____	_____
1926.202 -	Barricades provided where needed.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
(Subpart H)	<u>Materials Handling, Storage, Use and Disposal</u>			
1926.250 -	All materials stored and stacked properly.	_____	_____	_____
1926.250 -	Safety load limits of floors posted and observed.	_____	_____	_____
1926.250 -	Aisles and passageways kept clear.	_____	_____	_____
1926.251 -	Rigging equipment for material handling inspected on each shift and load limits observed.	_____	_____	_____
1926.252 -	Proper handling and disposal of waste materials.	_____	_____	_____
1926.252 -	All solvent waste, oily rags, and flammable liquids shall be kept in fire resistant covered containers until removed from worksite.	_____	_____	_____
(Subpart I)	<u>Tools - Hand and Power</u>			
1926.301 - (A)	All hand and power tools maintained in safe condition.	_____	_____	_____
1926.301 - (B)	All power operated tools properly guarded.	_____	_____	_____
1926.301 - (D)	All hand-held power tools equipped with proper switch.	_____	_____	_____
1926.302 -	Electric tools grounded or double insulated.	_____	_____	_____
1926.302 - (B)	Pneumatic power tools, fuel power tools, hydraulic power tools have required safeguards.	_____	_____	_____
1926.302 - (E)	Power-actuated tools have required safeguards and operated only by trained personnel.	_____	_____	_____
1926.303 -	Abrasive wheels and tools properly equipped and used.	_____	_____	_____
1926.304 -	Woodworking tools properly equipped and used.	_____	_____	_____
1926.305 -	Jacks rated and capacity not exceeded.	_____	_____	_____

		Yes	No	Explanation or Comment
(Subpart J)	<u>Welding and Cutting</u>			
1926.350	Transporting, moving, and storing compressed gas cylinders according to standards. (Upright, secured, valves protected, kept from sparks or heat)	_____	_____	_____
1926.350 (B)	Placing of cylinders for welding and cutting according to standards.	_____	_____	_____
1926.350 (D)	Employees instructed in safe welding and cutting practices.	_____	_____	_____
1926.352	Fire prevention measures taken according to standards.	_____	_____	_____
1926.353	Ventilation and protection in welding, cutting and heating according to standards.	_____	_____	_____
1926.353	Proper protective equipment provided.	_____	_____	_____
(Subpart K)	<u>Electrical</u>			
1926.400	Employees protected from electric shock by grounding, guarding, or other means.	_____	_____	_____
1926.400 (C) (2)	Before work is begun, determine location of exposed or concealed electric lines to avoid personal contact.	_____	_____	_____
1926.401 (A)	Portable equipment grounded or double insulated.	_____	_____	_____
1926.401 (F)	Extension cords three-wire type.	_____	_____	_____
1926.401 (H)	Temporary wiring properly installed.	_____	_____	_____
1926.401 (J)	Temporary lighting properly protected and installed.	_____	_____	_____
(Subpart L)	<u>Ladders and Scaffolds</u>			
1926.450 (A) (2)	Ladders with broken or missing rungs, broken side rails, or other defects removed from service.	_____	_____	_____
1926.450 (A)	Portable ladders have proper base, used at one to four pitch, top and bottom kept clear, properly secured.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1926.450 - (A) (9)	Ladder side rail extends 36" above landing area.	_____	_____	_____
1926.450 -	Job-made ladders according to standards.	_____	_____	_____
1926.451 -	Scaffolding footing and anchorage proper.	_____	_____	_____
1926.451 - (A) (3)	All scaffolding operations under competent supervision.	_____	_____	_____
1926.451 - (A) (4)(5)	Guardrails (42" high) and toeboards on all scaffolds and platforms more than 10 feet high.	_____	_____	_____
1926.451 - (A) (7)	Safety factor of "4" for scaffolds.	_____	_____	_____
1926.451 - (A) (8)	Damaged or weakened scaffold parts removed.	_____	_____	_____
1926.451 - (A)	Scaffold timber and planks according to standards.	_____	_____	_____
1926.451 - (A) (13)	Access ladder provided for scaffolds.	_____	_____	_____
1926.451 - (A) (6)	Wire mesh or equivalent provided on scaffolds when persons must pass under.	_____	_____	_____
1926.451 -	Other scaffold requirements according to standards.	_____	_____	_____
(Subpart M) <u>Floor and Wall Openings and Stairways</u>				
1926.500 - (B)	Floor and roof openings and holes effectively protected with standard guardrails or covers.	_____	_____	_____
1926.500 - (C)	Wall openings protected where opening is less than 3 feet above floor and where there is a drop of more than 4 feet.	_____	_____	_____
1926.500 - (D)	Open sided floors, platforms, runways more than 6 feet high equipped with standard guardrails.	_____	_____	_____
1926.501 -	Stairways equipped with railings and handrails.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
(Subpart N)	<u>Cranes, Derricks, Hoists, Elevators, and Conveyors</u>			
1926.550 - (A) (1)	Crane and derrick operations according to specifications and limitations of manufacturer.	_____	_____	_____
1926.550 - (A)	Operating speeds, warnings, instructions posted on equipment.	_____	_____	_____
1926.550 - (A) (4)	Hand signal illustrations posted on job site and used.	_____	_____	_____
1926.550 - (A) (5)	A competent person designated to inspect machinery and equipment prior to each use.	_____	_____	_____
1926.550 - (A) (6)	Inspection records available.	_____	_____	_____
1926.550 - (A) (7)	Wire rope used only according to standards.	_____	_____	_____
1926.550 - (A) (8)	Moving parts on equipment guarded.	_____	_____	_____
1926.550 - (A) (15)	Minimum clearance to electrical power line observed (never less than 10 feet) and person designated to observe and give warnings.	_____	_____	_____
1926.550 - (C) (16)	No modifications to equipment that will affect capacity or safe operation without manufacturer's written approval.	_____	_____	_____
1926.550 -	Crawler and truck cranes, operated, maintained, inspected according to standards.	_____	_____	_____
1926.550 -	Tower cranes and other cranes operated, maintained, inspected according to standards.	_____	_____	_____
1926.552 -	Material hoists, personnel hoists, and elevators operated according to specifications and limitations of manufacturer and according to standards.	_____	_____	_____
1926.552 - (B) (1)	Operating rules, including No Riders Allowed, posted at material hoists.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
(Subpart O)	<u>Motor Vehicles, Mechanized Equipment, and Marine Operations</u>			
1926.600 - (A)	Equipment marked with warning devices (reflectors, lights, etc.) after working hours when adjacent to public streets, highways.	_____	_____	_____
1926.601 -	Off highway motor vehicles comply with standards and checked at beginning of each shift.	_____	_____	_____
1926.602 -	Seat belts, brakes, operator protection on earth-moving equipment according to standards.	_____	_____	_____
1926.602 -	Fork lift trucks maintained and used according to standards.	_____	_____	_____
1926.603 -	Pile driving equipment, marine operations and equipment according to standards.	_____	_____	_____
(Subpart P)	<u>Excavations, Trenching and Shoring</u>			
1926.650 -	Daily inspection of excavations by designated individual.	_____	_____	_____
1926.650 - (A)	Walkways, runways, sidewalks unobstructed and properly supported if necessary.	_____	_____	_____
1926.651 - (A)	Utility companies contacted and advised of proposed excavation operations.	_____	_____	_____
1926.651 -	Angle of repose and/or supporting system determined and utilized according to standards.	_____	_____	_____
1926.652 -	Trenching requirements, bracing, other safeguards according to standards.	_____	_____	_____
(Subpart Q)	<u>Concrete, Concrete Forms, and Shoring</u>			
1926.700 -	Concrete buggies, buckets, pumping systems, trowels, and equipment according to standards.	_____	_____	_____
1926.700 - (B)	Reinforcing steel placing and tying according to standards.	_____	_____	_____
1926.701 -	Forms and shoring equipment according to standards.	_____	_____	_____
1926.701 - (A) (2)	Drawing and plans for framework, shoring etc. on jobsite.	_____	_____	_____

		<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
(Subpart R)	<u>Steel Erection</u>			
1926.750	Temporary or permanent floor according to standards. Safety nets where applicable.	_____	_____	_____
1926.751	Structural steel assembly according to standards.	_____	_____	_____
1926.752	Bolting, riveting, fitting up, and plumbing up according to standards.	_____	_____	_____
(Subpart S)	<u>Tunnels and Shafts, Caissons, Cofferdams and Compressed Air</u>			
1926.800	Tunnel and shafts according to standards.	_____	_____	_____
1926.801	Caissons according to standards.	_____	_____	_____
1926.802	Cofferdams according to standards.	_____	_____	_____
1926.803	Compressed air work according to standards.	_____	_____	_____
(Subpart T)	<u>Demolition</u>			
1926.850	Survey in writing made prior to start of demolition.	_____	_____	_____
1926.852	Chutes provided where required.	_____	_____	_____
1926.850	Utility service lines cut off or controlled.	_____	_____	_____
1926.853	Systematic removal according to standards.	_____	_____	_____
(Subpart U)	<u>Blasting and Use of Explosives</u>			
1926.900	Only authorized and qualified persons handle explosives.	_____	_____	_____
1926.901	Blaster qualified.	_____	_____	_____
1926.902	Transportation and storage of explosives and blasting agents according to standards.	_____	_____	_____

NOTE. Before blasting, consult the Internal Revenue Service - Alcohol, Tobacco and Firearms Division, Publication 740 (6-71).

(Subpart W) Rollover Protective Structures - Overhead Protection (ROPS)

1926.1000 -

MANUFACTURING DATES

January 1, 1972 or later
 July 1, 1971 - December 31, 1971
 July 1, 1970 - June 30, 1971
 July 1, 1969 - June 30, 1970
 Before July 1, 1969

EFFECTIVE DATES

April 1, 1973
 July 1, 1973
 January 1, 1974
 July 1, 1974
 Under review.

Coverage: Rubber-tired dozers, wheel-type agricultural and industrial tractors, rubber-tired self-propelled scrapers, rubber-tired front end loaders, crawler tractors, crawler loaders, and motor graders.

Industrial tractor means that class of wheel-type vehicle of more than 20 engine horsepower used in operations such as landscaping, construction services, loading, digging, ground scraping, and highway maintenance.

	<u>Yes</u>	<u>No</u>	<u>Explanation or Comment</u>
1926.1000 - Permanently affixed label listing			
1) Manufacturer's or fabricator's name and address.	_____	_____	_____
2) ROPS model number, if any.	_____	_____	_____
3) Machine make, model, or series number that the structure is designed to fit.	_____	_____	_____
1926.1000 - Vertical clearance of at least 52 inches from work deck to the ROPS at the point of ingress and egress.			
(C) (2)			
(11)			

NOTE: For more specific details on testing procedures, refer to the standards.

Any machine in use, equipped with rollover protective structures shall be deemed in compliance with this section if it meets the rollover protective structure requirements of the State of California, the U.S. Corps of Engineers, or the Bureau of Reclamation of the U.S. Department of the Interior in effect on April 5, 1972.

PERSONAL AND JOB SAFETY
UNIT I

ASSIGNMENT SHEET #2-COMplete A SAFETY PLEDGE

_____, who is enrolled in Vocational _____, will, as a part of the shop experience, operate machines, providing that the parent or guardian gives written permission.

It is understood that each student will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it. The student must assume responsibility for following safe practices, and we, therefore, ask that the student subscribe to the following safety pledge.

1. I promise to follow all safety rules for the shop.
2. I promise never to use a machine without first having permission from the instructor.
3. I will not ask permission to use a particular machine unless I have been instructed in its use and have made 100% on the safety test for that machine.
4. I will report any accident or injury to the teacher immediately.

Date _____ Student's signature _____

I hereby give my consent to allow my son or daughter to operate all machines and equipment necessary in carrying out the requirements of the course in which he/she is enrolled.

Date _____ Parent's signature _____

Parents are cordially invited to visit the shop to inspect the machines and to see them in operation.

(NOTE: Parental consent is necessary only if the student is a minor.)

PERSONAL AND JOB SAFETY
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

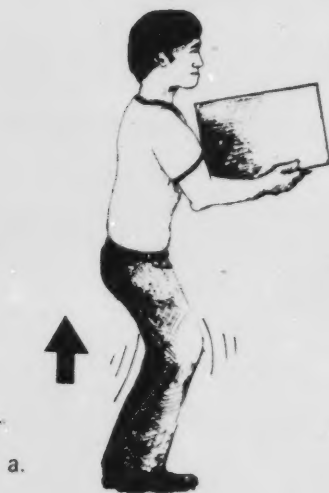
- | | |
|---|-----------------|
| _____ a. Any suddenly occurring, unintentional event which causes injury or property damage | 1. Carelessness |
| _____ b. Source of danger | 2. Hazard |
| _____ c. State or condition of being safe; freedom from danger, risk, or injury | 3. First aid |
| _____ d. Condition of being unsafe | 4. Accident |
| _____ e. Immediate, temporary care given to the victim of an accident or sudden illness until the services of a physician can be obtained | 5. OSHA |
| _____ f. Occupational Safety and Health Act | 6. Safety |

2. Describe in a short paragraph types of clothing a person should wear on the job.

3. List five rules for personal safety.

- a.
- b.
- c.
- d.
- e.

4. List five rules for general job safety.
 - a.
 - b.
 - c.
 - d.
 - e.
5. List five methods used to maintain a clean and orderly work area.
 - a.
 - b.
 - c.
 - d.
 - e.
6. Identify the correct way to lift heavy objects by circling the appropriate drawing.



7. Complete a safety checklist.
8. Complete a safety pledge form.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

PERSONAL AND JOB SAFETY
UNIT I

ANSWERS TO TEST

1. a. 4 d. 1
 b. 2 e. 3
 c. 6 f. 5
2. Description should include:
 - a. Pants and shirt should be snug fitting but allow for freedom of movement
 - b. Hard hat should be worn at all times
 - c. Safety shoes must be worn to protect the feet
 - d. Goggles and dust mask should be worn when working in a dangerous area
3. Any five of the following:
 - a. Wear clothing appropriate to the instructional activity being performed
 - b. Confine long hair before operating rotating equipment
 - c. Wear safety glasses; use suitable helmets and goggles for cutting, chipping, and grinding
 - d. Remove ties when working around machine tools or rotating equipment
 - e. Remove rings and other jewelry when working
 - f. Prevent accidents by working safely
 - g. Use soap and water frequently as a method of preventing skin diseases
4. Any five of the following:
 - a. Keep all hand tools sharp, clean, and in safe working order
 - b. Report any defective tools, machines, or other equipment to the supervisor
 - c. Retain all guards and safety devices
 - d. Operate a hazardous machine only after receiving instruction on how to operate the machine safely

- e. Report all accidents to the supervisor regardless of nature or severity
 - f. Have operator turn off power and make certain the machine has stopped running before leaving
 - g. Make sure all guards and barriers are in place
 - h. Disconnect the power from machine tools before performing the maintenance task of oiling or cleaning
 - i. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it
 - j. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held
 - k. Keep the work area clear of scraps and litter
 - l. Clean up any spilled liquids immediately
 - m. Clean the chips from a machine with a brush, not with a rag or bare hands
 - n. Do not use compressed air to clean your person or clothing
 - o. Use only approved scaffolding
 - p. Use a swing scaffold only after proper instruction and in accordance with OSHA regulations
5. Any five of the following:
- a. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning
 - b. Stack materials and supplies safely or store in proper place
 - c. Store tools and accessories safely in cabinets, on racks, or in other suitable devices
 - d. Clear working areas and workbenches of debris and other hazards
 - e. Clean and free floors from obstructions and slipping substances
 - f. Free aisles, traffic areas, and exits of materials and other debris
 - g. Know the proper procedures to follow in keeping the work area clean and orderly
 - h. Keep sufficient brooms, brushes, and other housekeeping equipment readily available
6. a
7. Evaluated to the satisfaction of the instructor
8. Evaluated to the satisfaction of the instructor



MORTARS UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match terms to the correct definitions, list ingredients of mortar, and list factors to consider when mixing mortar. The student should be able to select common ratios of mortar and demonstrate the ability to mix mortar. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with mortars to the correct definitions.
2. List the ingredients of mortar.
3. Match types of mortar to specific use.
4. List factors to consider when mixing mortar.
5. Select from a list those factors that affect mortar consistency.
6. Select from a list common ratios of mortar mixes.
7. State the effects of salt on mortar.
8. List the steps used when mixing mortar with a mechanical mixer and by hand.
9. Discuss care of the mixer.
10. Demonstrate the ability to:
 - a. Mix 1:1:6 mortar with mechanical mixer.
 - b. Mix 1:1:6 mortar by hand using mortar box.

MORTARS UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Discuss terminal and specific objectives.
- D. Discuss information sheet.
- E. Demonstrate and discuss procedures outlined on the job sheets.
- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Equipment for Mixing Mortar
 - 2. TM 2--Equipment for Mixing Mortar (Continued)
- D. Job sheets
 - 1. Job Sheet #1--Mix 1:1:6 Mortar with Mechanical Mixer
 - 2. Job Sheet #2--Mix 1:1:6 Mortar by Hand Using Mortar Box

E. Test

F. Answers to test

II. References:

- A. Dalzell, J. Ralph, and Townsend, Gilbert. *Masonry Simplified*. Vol. 1. Chicago: American Technical Society, 1956.
- B. Dalzell, J. Ralph. *Simplified Masonry Planning and Building*. New York: McGraw-Hill Book Co., Inc., 1955.
- C. Toennies, Henry, and Merten, John E. *Concrete Masonry Vocational Training*. Student manual. McLean, Virginia: National Concrete Masonry Association, 1973.
- D. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.

MORTARS
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Workability--Condition of mortar that is easily handled with a trowel
- B. Consistency--Degree of wetness and workability of mortar
- C. Durability--Ability to withstand wear, abrasion, and weathering
- D. Appearance--Careful proportioning to ensure that the same amounts of ingredients are used each time mixing is done
- E. Portland cement--Mixture of burned clay and limestone finely ground for making concrete or mortar
- F. Mortar--Plastic mixture of cementing materials, aggregate, and water
- G. Masonry cement--Mill-mixed combination of portland cement, lime, and additives
- H. Efflorescence--Deposit of white powder on the surface of masonry caused from leaching of water-soluble salts in the masonry by evaporation of water

II. Ingredients of mortar

A. Using portland cement

- 1. Portland cement
- 2. Hydrated lime
- 3. Sand
- 4. Water

B. Using masonry cement

- 1. Masonry cement Type II
- 2. Sand
- 3. Water

INFORMATION SHEET

(NOTE: Mortar types are determined by proportions of ingredients.)

MORTAR PROPORTIONS BY VOLUME

Portland Cement-Lime Mortars			
Type	Portland Cement	Hydrated Lime or Lime Putty	Sand
M	1	1/4	3
S	1	1/2	4 1/2
N	1	1	6
O	1	2	9
K	1	3	12
Masonry Cement Mortars			
Type	Portland Cement	Masonry Cement Type II	Sand
M	1	1	6
S	1/2	1	4 1/2
N	—	1	3
O	—	1 (Type I or II)	3

III. Mortars and their uses

Kind of Masonry	Type of Mortar
Foundations:	
Footings	M or S
Walls of solid units	M, S, or N
Walls of hollow units	M or S
Hollow walls	M or S
Masonry other than foundation masonry:	
Piers of solid masonry	M, S, or N
Piers of hollow masonry	M or S
Walls of solid masonry	M, S, N, or O
Walls of solid masonry, other than parapet walls or rubble stone walls, not less than 12 inches thick nor more than 35 feet in height, supported laterally at intervals not exceeding 12 times the wall thickness	M, S, N, O, or K
Walls of hollow units, load-bearing or exterior, and hollow walls 12 inches or more in thickness	M, S, or N
Linings of existing masonry, either above or below grade	M or S
Masonry other than above	M, S, or N

INFORMATION SHEET

IV. Factors to consider when mixing mortar

- A. Mix to proper consistency
- B. Use materials specified
- C. Use clean water for mixing
- D. Mix material for at least three minutes in a mechanical mixer
- E. Turn dry material over at least three times before adding water when hand mixing
- F. Do not oversand (lean mortar)
- G. Do not undersand (fat mortar)

(NOTE: Materials should be carefully measured and thoroughly mixed if uniformity of quality is to be obtained.)

V. Factors that affect mortar consistency

- A. Air temperature
- B. Wind
- C. Freezing
- D. Amount of sand used
- E. Exposure to sun
- F. Mixing time

VI. Common ratios of mortar mixes

A. Portland cement-lime mortar

1. 1:25:3

- a. 1 part portland cement
- b. 1/4 part hydrated lime or lime putty
- c. 3 parts sand

INFORMATION SHEET

2. 1:50:4.25
 - a. 1 part of portland cement
 - b. 1/2 part of hydrated lime or lime putty
 - c. 4 1/4 part sand
3. 1:1:6
 - a. 1 part portland cement
 - b. 1 part hydrated lime
 - c. 6 parts sand
4. 1:2:9
 - a. 1 part portland cement
 - b. 2 parts hydrated lime or lime putty
 - c. 9 parts sand
5. 1:3:12
 - a. 1 part portland cement
 - b. 3 parts hydrated lime
 - c. 12 parts sand

B. Masonry cement mortars

(NOTE: Where colored mortar is needed, color should be used according to manufacturer's recommendations.)

1. 1:1:6
 - a. 1 part portland cement
 - b. 1 part masonry cement Type II
 - c. 6 parts sand
2. .50:1:4.50
 - a. 1/2 part portland cement
 - b. 1 part masonry cement Type II
 - c. 4 1/2 parts sand

INFORMATION SHEET

3. 1:3
 - a. 1 part masonry cement Type II
 - b. 3 parts sand
4. 1:3
 - a. 1 part masonry cement Type I or Type II
 - b. 3 parts sand

VII. Effects of salt on mortar

(NOTE: Efflorescence on masonry walls results from the evaporation of water from the face of the wall.)

- A. Detracts greatly from the appearance of the wall
- B. Requires extra man-hours for cleaning

(NOTE: At the end of each day, cover walls with waterproof covers overhanging at least 2 feet to keep out moisture.)

- C. Kills cement

(NOTE: Water used for mixing mortar should be clean and suitable for drinking. Water containing acids, alkalies, salts, and organic substances will affect the time and rate of set and the strength of the mortar.)

- D. Corrodes metals that may be in walls

VIII. Procedure for mixing mortar (Transparencies 1 and 2)

A. Mechanical mixer

1. Add approximately one-half of water required
2. Add one-half of required sand as the mixing action continues
3. Add cement
4. Add lime
5. Add more water if necessary
6. Add remainder of sand
7. Add water to mix to proper consistency

INFORMATION SHEET

B. Hand mixing

1. Secure leak-proof mortar box
2. Add sand
3. Add cement on top of sand
4. Add lime on top of cement and sand
5. Mix by cutting with mixing hoe and pulling toward end
6. Cut ingredients at least three times
7. Add about one-half the water required
8. Continue to mix mortar by cutting and adding water until proper consistency is acquired

IX. Care of mixer

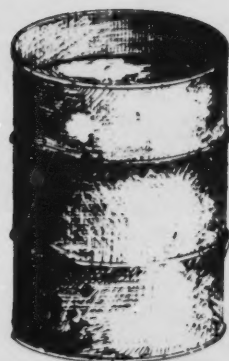
(NOTE: Care for mixer as if you owned it. The mixer is a very expensive piece of machinery.)

- A. Check oil daily
- B. Change oil according to manufacturer's specifications
- C. Grease moving parts of mixer
- D. Keep mixer clean using brush and water

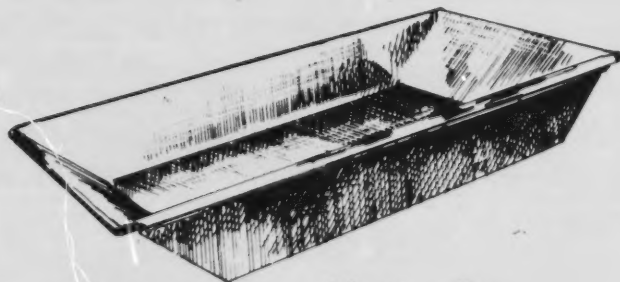
(CAUTION: Do not let mortar get hard on any part of the mixer.)

- E. Use safety gas can that meets OSHA regulations

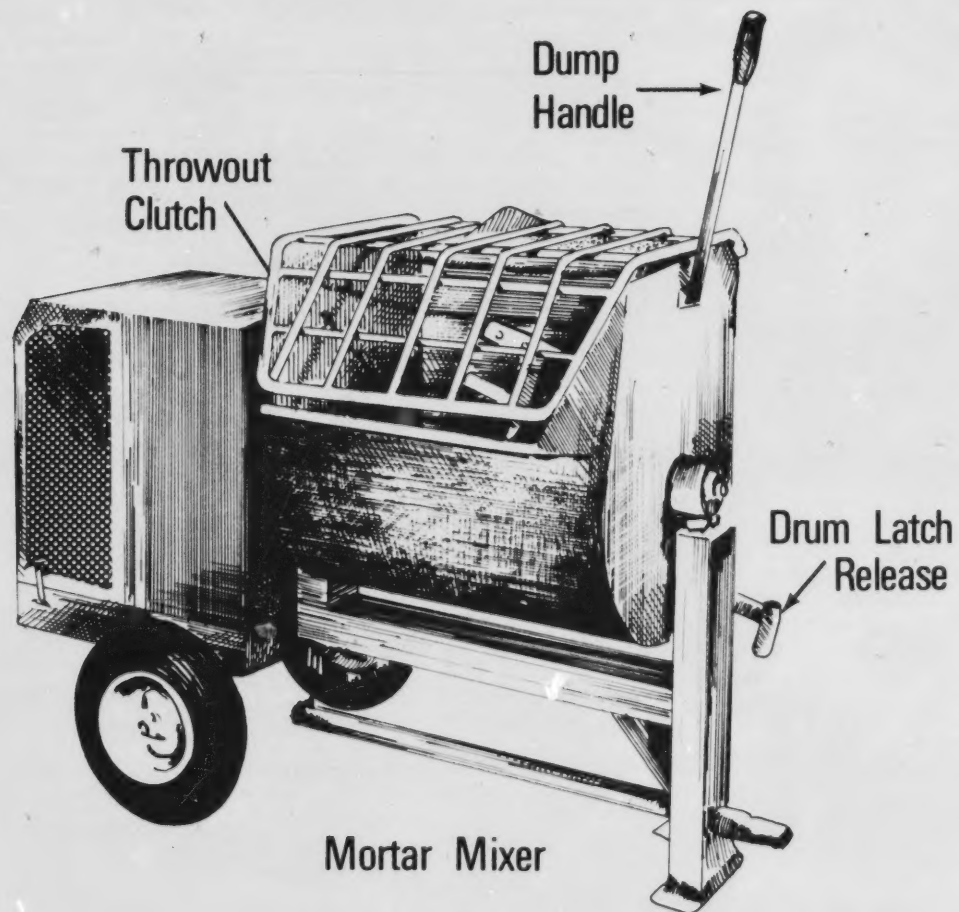
Equipment for Mixing Mortar



Water Barrel



Mortar Box



Mortar Mixer

Equipment for Mixing Mortar

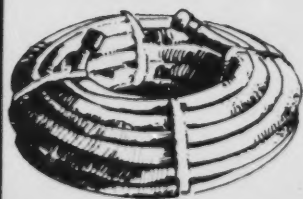
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Safety Goggles



Mortar Hoe



Water Hose



Pail



Square-Pointed
Shovel

MORTARS
UNIT I

JOB SHEET #1-MIX 1:1:6 MORTAR WITH MECHANICAL MIXER

I. Equipment and materials

- A. Mortar mixer
- B. Mortar box
- C. Water barrel
- D. Shovel, #2 square-pointed
- E. Pail, 5 gallon
- F. Water hose with nozzle
- G. Safety goggles
- H. Portland cement, 1 bag (1 cu ft)
- I. Hydrated lime, 1 cu ft
- J. Sand, 6 cu ft
- K. Water
- L. Box, 1 cu ft

II. Procedure

- A. Check mixer to see if it is level
- B. Check mixing drum to make sure it is clean
- C. Check gas tank to see if it is full
- D. Make sure safety guard is down on drum
- E. Start mixer
- F. Close cowl
- G. Throw in clutch

(NOTE: An electric mixer may also be used.)

- H. Put five gallons of clean water into drum

JOB SHEET #1

- I. Measure out sand using one cubic foot box
- J. Fill cu ft box with sand and dump it on floor
- K. Repeat procedure I until you have 6 cu ft of sand measured
(NOTE: Notice how many #2 shovels of sand are needed to fill the cu ft box. When shoveling sand into mixer, you can shovel half of the sand. Make sure you use the same shovel each time.)
- L. Shovel half the sand measured into the mixer using the #2 square-pointed shovel
- M. Set bag of portland cement on top of drum guard bag splitter
- N. Dump all the cement into drum gradually
- O. Set 1 cu ft of hydrated lime on top of drum guard bag splitter
- P. Dump lime into drum gradually
- Q. Add only enough water so the mixer will not stall
- R. Shovel in the remainder of the sand, using #2 square-pointed shovel
(NOTE: Notice how many shovels of measured sand were used.)
- S. Add enough water to the drum to get the correct consistency
- T. Mix materials at least 3 to 5 minutes
- U. Wet mortar box with water
- V. Hold dump handle firmly at the top, release drum latch, and dump materials into mortar box
(NOTE: This is done after mortar is mixed to correct consistency.)
- W. Push back on drum handle until it is in a locked position
- X. Empty 5 gallons of water into drum for next batch
- Y. Use water hose with nozzle to clean drum thoroughly while mixer is running if no more mortar is going to be mixed
(CAUTION: Do not use any tools for cleaning drum while mixer is running.)
- Z. Dump out water and continue cleaning drum with water hose until it is completely clean
- AA. Disengage clutch and shut off engine

MORTARS
UNIT I

JOB SHEET #2--MIX 1:1:6 MORTAR BY HAND USING MORTAR BOX

I. Tools, materials, and equipment

- A. Mortar box
- B. Water barrel
- C. Mortar hoe
- D. Shovel, #2 square-pointed
- E. Water hose with nozzle
- F. Pail, 5 gallon
- G. Safety goggles
- H. Portland cement, 1 bag (1 cu ft)
- I. Hydrated lime, 1 cu ft
- J. Sand, 6 cu ft
- K. Water
- L. Box, 1 cu ft

II. Procedure

- A. Check to see if mortar box is clean
- B. Level mortar box
- C. Make sure mortar box is watertight
- D. Measure sand with cu ft box
- E. Fill box and dump it on floor

(NOTE: Notice number of shovels of sand used to fill box.)
- F. Shovel all of the measured sand into mortar box using #2 square-pointed shovel
- G. Level sand in the mortar box with mortar hoe

JOB SHEET #2

- H. Empty bag of portland cement on top of sand in the mortar box
- I. Empty 1 cu ft of hydrated lime on top of cement
- J. Start pulling the dry materials to one end of the mortar box
- K. Pull material to opposite end of box with the mortar hoe, using a cutting motion
- L. Repeat mixing of dry material once more
- M. Empty 5 gallon pail of clean water at empty end of box
- N. Pull dry material into water gradually, mixing with hoe
(NOTE: Use a push-pull motion with hoe.)
- O. Continue pulling and mixing until most of the water has been absorbed
- P. Add water as needed and mix materials thoroughly
(CAUTION: Do not add too much water.)
- Q. Continue mixing and adding water until the correct consistency is reached

MORTARS
UNIT I

TEST

1. Match terms on the right to the correct definitions.

- | | |
|---|--------------------|
| _____ a. Degree of wetness and workability of mortar | 1. Efflorescence |
| _____ b. Deposit of white powder on the surface of masonry caused from leaching of water-soluble salts in the masonry by evaporation of water | 2. Masonry cement |
| _____ c. Condition of mortar that is easily handled with a trowel | 3. Mortar |
| _____ d. Mill-mixed combination of portland cement, lime, and additives | 4. Portland cement |
| _____ e. Mixture of burned clay and limestone finely ground for making concrete or mortar | 5. Appearance |
| _____ f. Ability to withstand wear, abrasion, and weathering | 6. Durability |
| _____ g. Plastic mixture of cementing materials, aggregate, and water | 7. Workability |
| _____ h. Careful proportioning to ensure that the same amounts of ingredients are used each time mixing is done | 8. Consistency |

2. List the ingredients of mortar.

- a. Using portland cement

1)

2)

3)

4)

- b. Using masonry cement

1)

2)

3)

3. Match the types of mortars on the right to the specific use by writing the correct numbers in the blanks. Each blank will have more than one answer.

_____ a. Footings	1. Type M
_____ b. Walls of solid units	2. Type S
_____ c. Walls of hollow units	3. Type N
_____ d. Hollow walls	4. Type O
_____ e. Piers of solid masonry	5. Type K
_____ f. Piers of hollow masonry	
_____ g. Walls of solid masonry	
_____ h. Walls of solid masonry, other than parapet walls or rubble stone walls, not less than 12 inches thick nor more than 35 feet in height, supported laterally at intervals not exceeding 12 times the wall thickness	
_____ i. Walls of hollow units, load-bearing or exterior, and hollow walls 12 inches or more in thickness	
_____ j. Linings of existing masonry, either above or below grade	
_____ k. Other masonry	

4. List four factors to consider when mixing mortar.

- a.
- b.
- c.
- d.

5. Select from the list below those factors that affect mortar consistency by placing an "X" in the blanks provided.

- _____ a. Air temperature
- _____ b. Wind
- _____ c. Freezing

- ☐ d. Amount of sand used
 - ☐ e. Exposure to sun
 - ☐ f. Humidity
 - ☐ g. Time of day
 - ☐ h. Mixing time
6. Select from the list below common ratios of mortar mixes by placing an "X" in the blanks provided.
- ☐ a. 1:.25:3
 - ☐ b. 1:.50:3
 - ☐ c. 2:4:1
 - ☐ d. 1:1:6
 - ☐ e. 1:2:9
 - ☐ f. 6:1:1
 - ☐ g. 1:3:12
 - ☐ h. .50:1:4.50
 - ☐ i. 1:3
 - ☐ j. 3:1:6
7. State the effects of salt on mortar.
- a.
 - b.
 - c.
 - d.
8. List the steps used when mixing mortar.
- a. Mechanical mixer

- b. Hand mixing

- 9. Discuss care of the mixer.

- 10. Demonstrate the ability to:

- a. Mix 1:1:6 mortar with mechanical mixer.
- b. Mix 1:1:6 mortar by hand using mortar box.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

MORTARS
UNIT I

ANSWERS TO TEST

1.

a. 8	e. 4
b. 1	f. 6
c. 7	g. 3
d. 2	h. 5
2.
 - a. Using portland cement
 - 1) Portland cement
 - 2) Hydrated lime
 - 3) Sand
 - 4) Water
 - b. Using masonry cement
 - 1) Masonry cement Type II
 - 2) Sand
 - 3) Water
3.

a. 1, 2	g. 1, 2, 3, 4
b. 1, 2, 3	h. 1, 2, 3, 4, 5
c. 1, 2	i. 1, 2, 3
d. 1, 2	j. 1, 2
e. 1, 2, 3	k. 1, 2, 3
f. 1, 2	
4. Any four of the following:
 - a. Mix to proper consistency
 - b. Use materials specified
 - c. Use clean water for mixing

- d. Mix material for at least three minutes in a mechanical mixer
 - e. Turn dry material over at least three times before adding water when hand mixing
 - f. Do not oversand (lean mortar)
 - g. Do not undersand (fat mortar)
5. a, b, c, d, e, h
6. a, d, e, g, h, i
7. a. Detracts greatly from the appearance of the wall
- b. Requires extra man-hours for cleaning
- c. Kills cement
- d. Corrodes metals that may be in walls
8. a. Mechanical mixer
- 1) Add approximately one-half of water required
 - 2) Add one-half of required sand as the mixing action continues
 - 3) Add cement
 - 4) Add lime
 - 5) Add more water if necessary
 - 6) Add remainder of sand
 - 7) Add water to mix to proper consistency
- b. Hand mixing
- 1) Secure leak-proof mortar box
 - 2) Add sand
 - 3) Add cement on top of sand
 - 4) Add lime on top of cement and sand
 - 5) Mix by cutting with mixing hoe and pulling toward end
 - 6) Cut ingredients at least three times

- 7) Add about one-half the water required
 - 8) Continue to mix mortar by cutting and adding water until proper consistency is acquired
9. Discussion should include:
 - a. Check oil daily
 - b. Change oil according to manufacturer's specifications
 - c. Grease moving parts of mixer
 - d. Keep mixer clean using brush and water
 - e. Use safety gas can that meets OSHA regulations
10. Performance skills evaluated to the satisfaction of the instructor

MASONRY UNITS UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to label the parts of a brick, describe the effects of absorption on hard and soft brick, and identify brick according to position in wall. The student should also be able to identify masonry units and accessories. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with masonry units to the correct definitions.
2. Label the parts of a brick.
3. Name two kinds of brick according to dimensions.
4. Classify brick according to modular and nonmodular.
5. Identify brick according to position in the wall.
6. Describe effects of absorption of hard and soft brick on mortar and bond.
7. Name types of structural clay tile units.
8. List uses of structural clay tile.
9. Identify parts of a concrete masonry unit.
10. Name two types of concrete masonry units.
11. Identify shapes of concrete masonry units.
12. Name kinds of sills and lintels.
13. Name types of cut stone.
14. List principle uses of cut stone.
15. Describe the difference between cast and cut stone.
16. Name principle uses of refractory brick.
17. Name principle uses of prefabricated units.
18. Identify accessories used with masonry units.
19. Name principle uses of accessories.

MASONRY UNITS
UNIT II

SUGGESTED ACTIVITIES

- I. Instructor:
 - A. Provide student with objective sheet.
 - B. Provide student with information sheet.
 - C. Make transparencies.
 - D. Discuss terminal and specific objectives.
 - E. Discuss information sheet.
 - F. Provide student with an opportunity to see all types of brick, block, and accessories.
 - G. Give test.
- II. Student:
 - A. Read objective sheet.
 - B. Read and study information sheet.
 - C. Take test.

INSTRUCTIONAL MATERIALS

- I. Included in this unit:
 - A. Objective sheet
 - B. Information sheet
 - C. Transparency masters
 - 1. TM 1--Parts of a Brick
 - 2. TM 2--Kinds of Modular and Nonmodular Brick
 - 3. TM 3--Position of Brick in Wall
 - 4. TM 4--Structural Clay Tiles

5. TM 5--Uses of Structural Clay Tile
6. TM 6--Parts of a Concrete Masonry Unit
7. TM 7--Types of Concrete Masonry Units
8. TM 8--Types of Concrete Masonry Units (Continued)
9. TM 9--Types of Concrete Masonry Units (Continued)
10. TM 10--Types of Concrete Masonry Units (Continued)
11. TM 11--Sills and Lintels
12. TM 12--Sills and Lintels (Continued)
13. TM 13--Sills and Lintels (Continued)
14. TM 14--Cut Stone
15. TM 15--Types of Prefab Units
16. TM 16--Accessories
17. TM 17--Accessories (Continued)
18. TM 18--Accessories (Continued)
19. TM 19--Accessories (Continued)

E. Test

F. Answers to test

II. References:

- A. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. McLean Virginia: Brick Institute of America, 1973.
- B. Dalzell, J. Ralph, and Townsend, Gilbert. *Masonry Simplified*. Vol. 1. Chicago: American Technical Society, 1956.
- C. Graham, Frank D. *Audels Mason and Builders Guide*. Vol 1. Indianapolis: Howard W. Sams and Co., Inc./Theodore Audel and Co., 1961.

MASONRY UNITS
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Modular--Unit with nominal dimensions based on the 4-inch module
- B. Nonmodular--Variations in thickness of standard brick and oversize brick
- C. Roman brick--Solid masonry unit with nominal dimensions of 2" x 4" x 12"

(NOTE: Special dimension is 1 5/8" x 3 3/4" x 11 3/4".)
- D. Norman brick--Brick with nominal dimensions of 2 2/3" x 4" x 12"
- E. Standard brick--Brick with nominal dimensions of 2 1/4" x 3 3/4" x 8"
- F. Prefab unit--Masonry construction fabricated in a location other than its final inservice location in the structure
- G. Precast unit--Unit that may be cast on job location, such as tilt-up wall or precast panel
- H. Sill--Lowest member beneath an opening such as a window or door
- I. Lintel--Beam placed over an opening in a wall
- J. Cut stone--Dimension stone; blocks of stone cut or quarried to be cut to specified dimensions
- K. Cast stone--Man-made stone; generally made with reinforced concrete
- L. Refractory--Brick made of refractory ceramic materials which will resist high temperatures
- M. Accessory--Item needed for reinforcement and anchorage of masonry unit

II. Parts of a brick (Transparency 1)

- A. Face

(NOTE: The exposed surface of a wall or masonry unit is called the *face*.)

- B. Bottom

INFORMATION SHEET

- C. Top
- D. End
- E. Core

(NOTE: Brick will vary in color and texture. Bricks may also be solid or cored. When selecting brick, these characteristics are a very important part of the description.)

III. Kinds of brick (Transparency 2)

- A. Modular
- B. Nonmodular

(NOTE: Nonmodular brick sometimes are referred to as *standard*.)

IV. Modular vs nonmodular brick (Transparency 2)

A. Modular

- 1. Standard
- 2. Engineer
- 3. Economy 8

(NOTE: This is sometimes referred to as *jumbo closure*.)

- 4. Double
- 5. Roman
- 6. Norman
- 7. Norwegian
- 8. Economy 12

(NOTE: This is sometimes referred to as *jumbo utility*.)

- 9. Triple
- 10. "SCR brick"
- 11. 6" Norwegian
- 12. 6" Jumbo
- 13. 8" Jumbo

INFORMATION SHEET

B. Nonmodular

1. Three inch
2. Standard
3. Oversize

V. Position of brick in wall (Transparency 3)

- A. Stretcher
- B. Header
- C. Rowlock stretcher or shiner
- D. Rowlock header
- E. Soldier
- F. Sailor

VI. Absorption of brick

(NOTE: Do not use brick with very high or very low absorption.)

A. Hard brick

1. Is very dense
2. Has low suction or absorption

B. Soft brick

1. Is porous
2. Has high suction or absorption

VII. Structural clay tile units (Transparency 4)

- A. Ceramic glaze finish
- B. Unglazed finish

(NOTE: Structural tile units come in many shapes and colors and are numbered in series such as 6TC stretcher; 6T4-12" B.N.; 3T4 half B.N.; 6T50 cove base.)

INFORMATION SHEET

VIII. Uses of structural clay tile (Transparency 5)

- A. Toilet areas
- B. Locker rooms
- C. Meat packing plants
- D. Stairways
- E. Load-bearing walls
- F. Nonload-bearing walls

IX. Parts of a concrete masonry unit (Transparency 6)

- A. Face shell
- B. Cross web
- C. Hollow cell or core
- D. Vertical shell

X. Types of concrete masonry units (Transparency 7)

- A. Lightweight
- B. Standard

XI. Common concrete masonry units (Transparencies 7, 8, 9, and 10)

(NOTE: Concrete masonry units come in various sizes. Sizes shown on transparencies are for 8" units.)

- A. Hollow load-bearing
- B. Solid load-bearing
- C. Hollow, nonload-bearing
- D. Concrete brick
- E. Standard concrete block
- F. Corner and sash block

INFORMATION SHEET

G. Bull nose (B.N.) block

H. Double bull nose

I. L-corner block

J. Half block

(NOTE: Half blocks range in size from 4" to 12" and may have square corners, bull nose, or sash.)

K. Lintel block

L. Bond beam block

M. Header block

N. Ranch stone or split block

(NOTE: Concrete masonry units are made from both heavyweight and lightweight materials in a great variety of shapes and sizes.)

XII. Kinds of sills and lintels (Transparencies 11, 12, and 13)

A. Sills

1. Slip
2. Lug
3. Precast
4. Cast-in-place
5. Brick

B. Lintels

1. Precast
2. Cast-in-place
3. Lintel block
4. Angle iron to receive masonry unit
5. Reinforced brick

INFORMATION SHEET

XIII. Types of cut stone (Transparency 14)

- A. Limestone
- B. Sandstone
- C. Granite
- D. Slate

XIV. Uses of cut stone

- A. Stone trim
- B. Neat appearance
- C. Decorative pattern
- D. Architectural design
- E. Elaborate buildings

XV. Difference between cast and cut stone

- A. Cast stone--Made with concrete
- B. Cut stone (dimension stone)--Mined from a quarry and cut to size

(NOTE: Cast stone may be any concrete member that is cast in forms at a place other than its final position of use.)

XVI. Principle uses of refractory brick

- A. High temperature furnaces
- B. Fireplace firebox
- C. Acid tanks and other chemical tanks

(NOTE: Refractory brick is treated with acid before use.)

- D. High pressure areas

(NOTE: The deterioration of the face of the brick would be the determining factor.)

INFORMATION SHEET

XVII. Principle uses of prefabricated units (Transparency 15)

- A. Walls
- B. Roofs
- C. Tilt-up

XVIII. Accessories used with masonry units (Transparencies 16, 17, 18, and 19)

A. Masonry wall reinforcement

(NOTE: The reinforcement can be brick and brick, block and block, or brick and block.)

- B. Corrugated metal tie
- C. Dove-tail anchor
- D. Adjustable wall tie

XIX. Principle uses of accessories

A. Masonry wall reinforcement

- 1. Crack control
- 2. Tensile wall strength
- 3. Bonding and reinforcing composite walls
- 4. Bonding and reinforcing cavity walls

B. Metal or wall ties

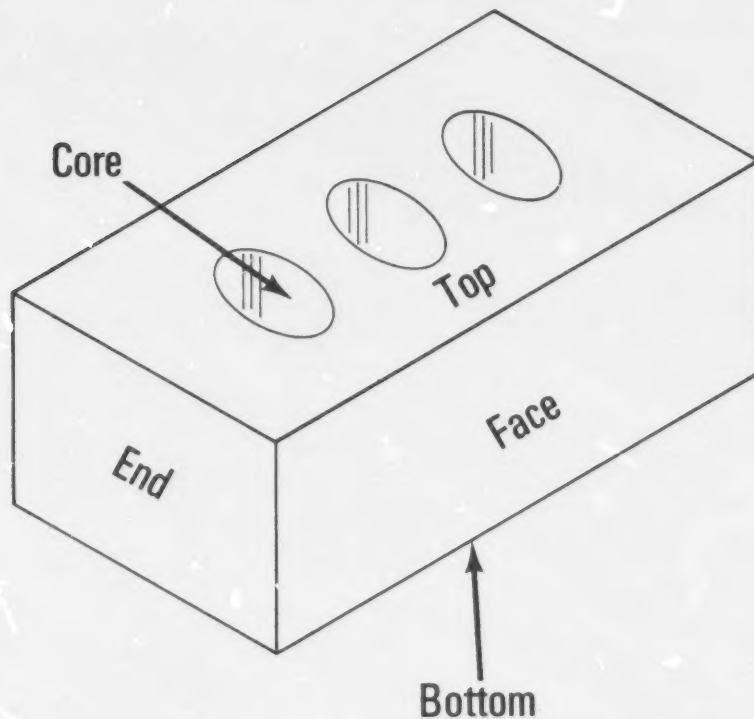
- 1. Tying veneer walls to frame or back-up
- 2. Attaching veneer walls to concrete walls, beams, or columns
- 3. Cavity walls with rigid insulation

(NOTE: These ties are adjustable.)

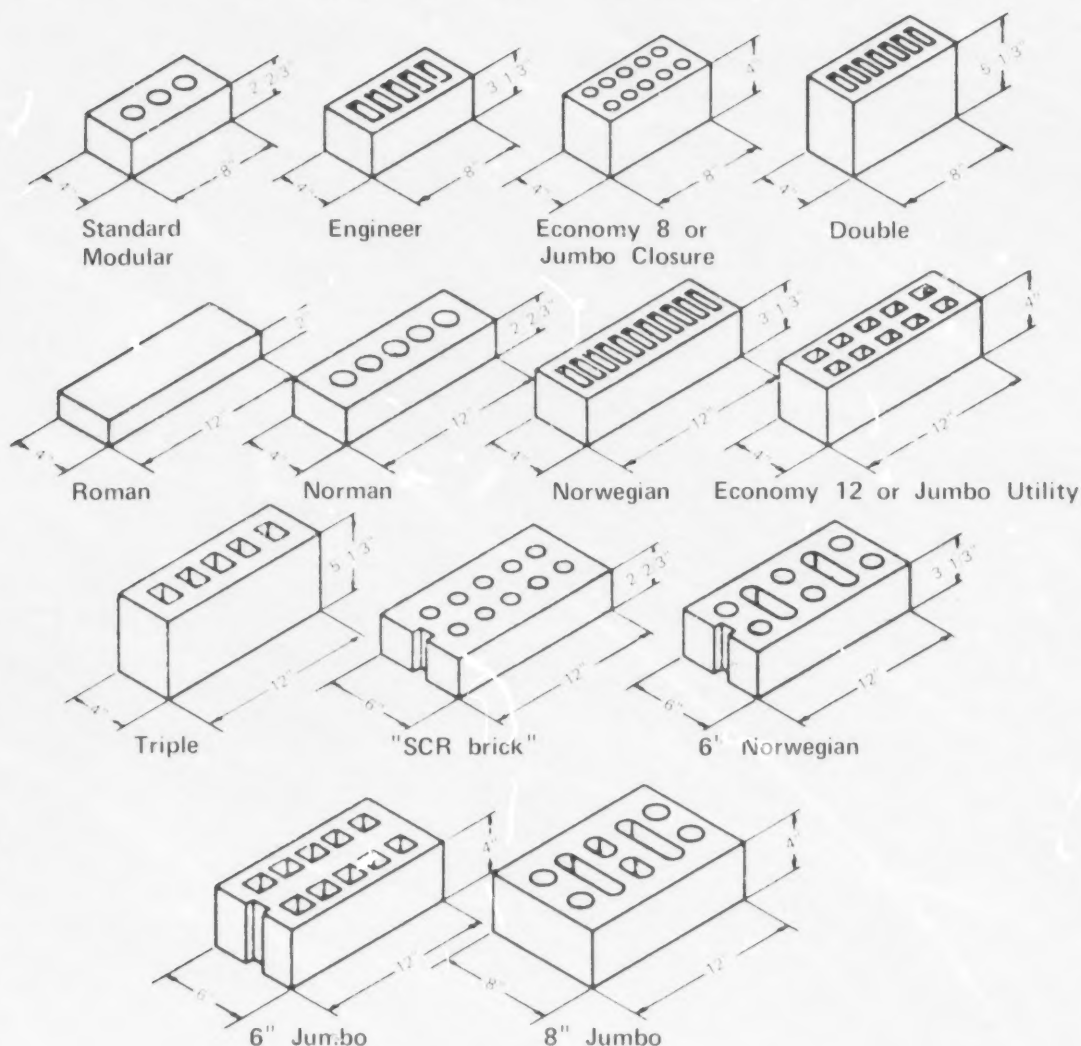
- 4. Cavity walls with air space or loose insulation
- 5. Window and door frame

(NOTE: Window and door anchors are furnished by the manufacturer of window and door frames.)

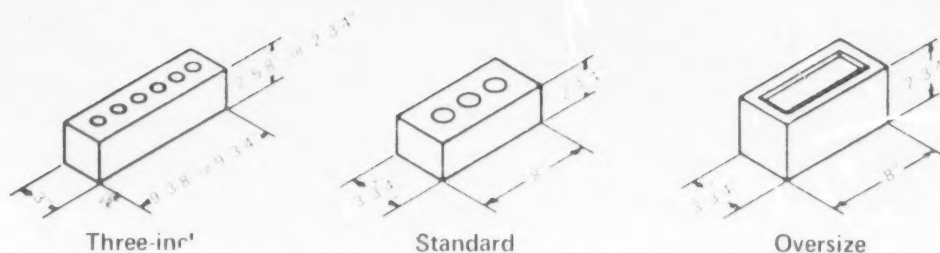
Parts of a Brick



Kinds of Modular and Nonmodular Brick

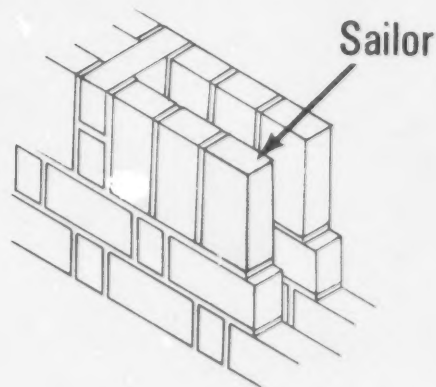
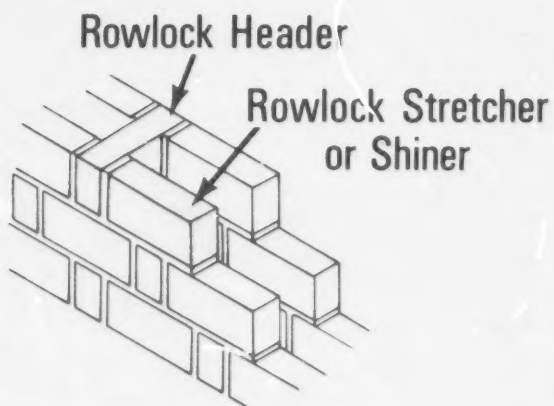
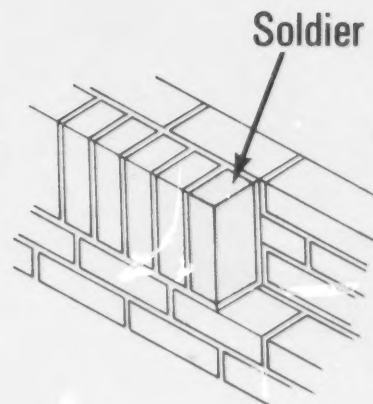
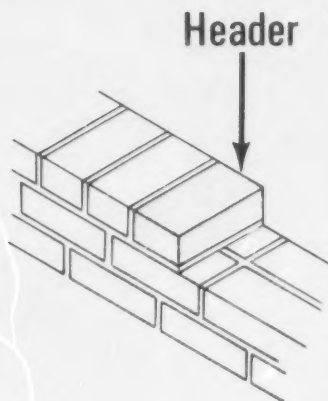
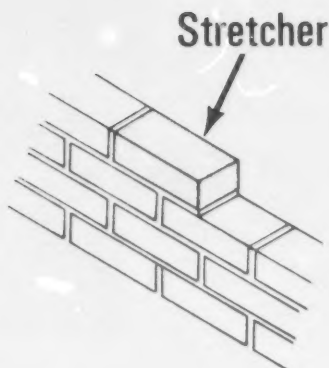


Modular Brick (Nominal Dimensions)

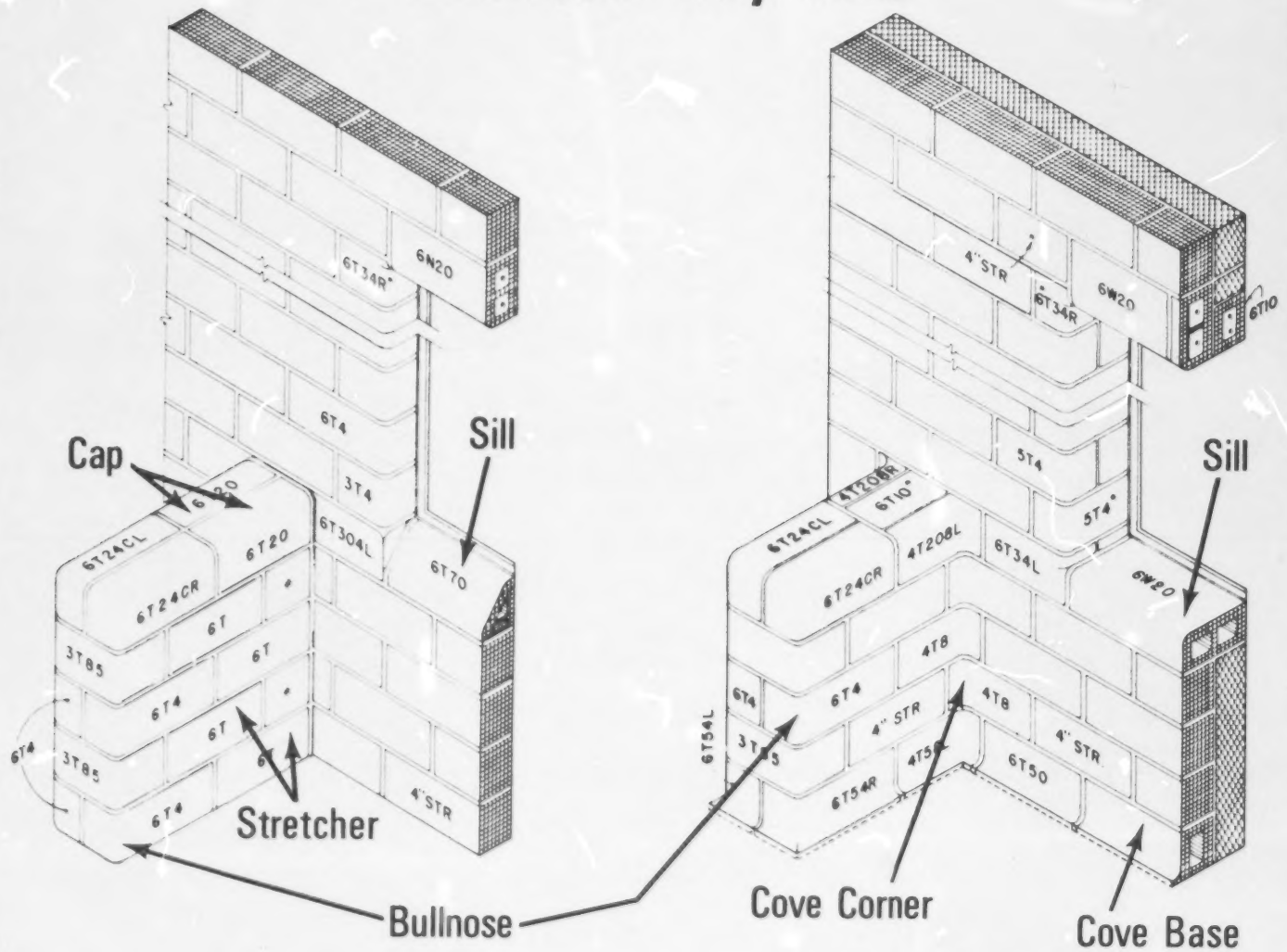


Nonmodular Brick (Actual Dimensions)

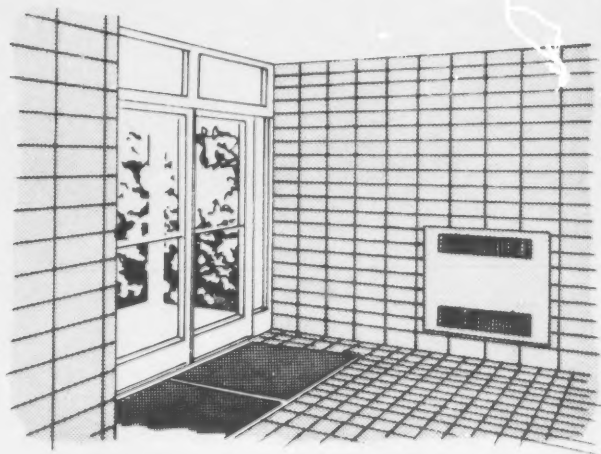
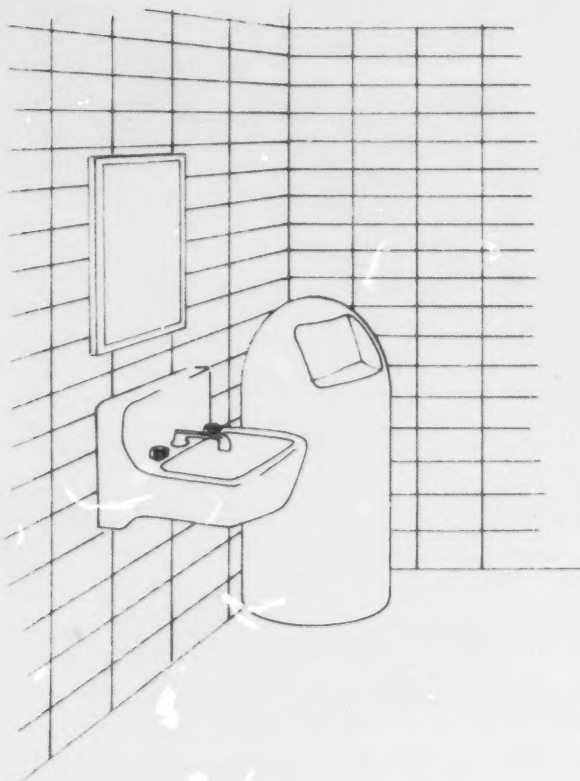
Position of Brick In Wall



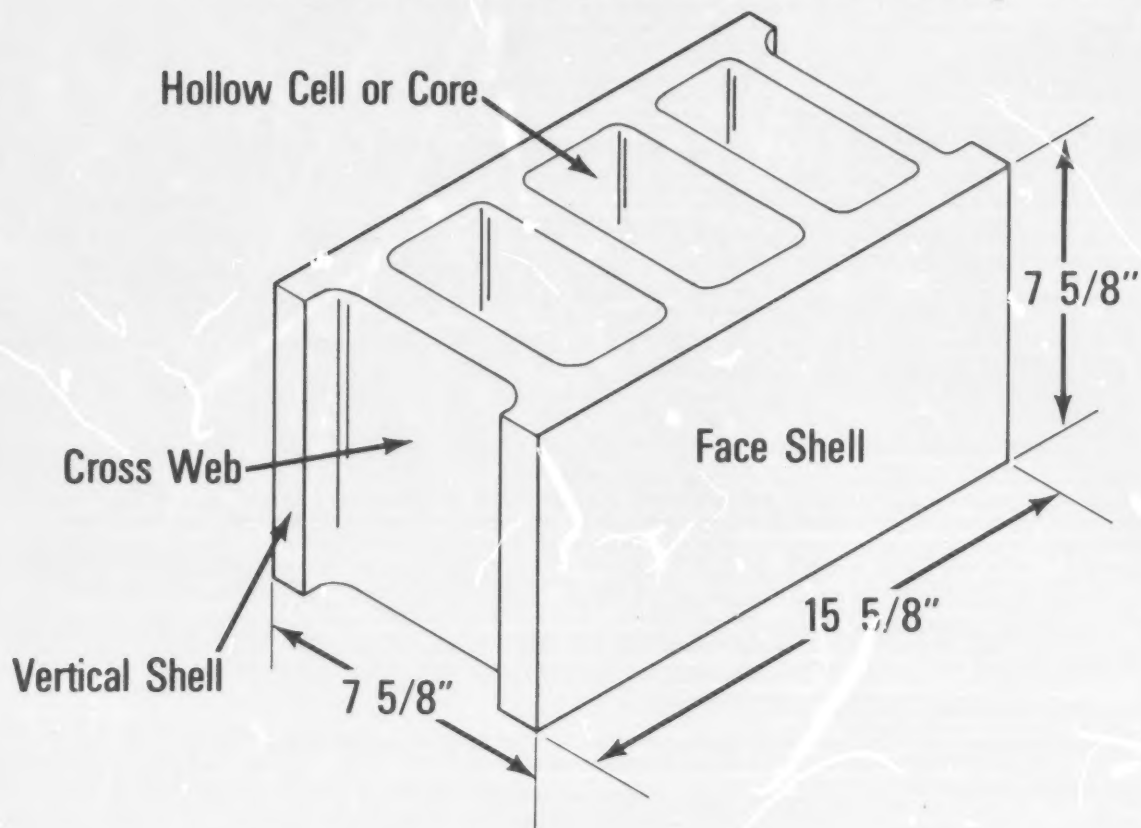
Structural Clay Tiles



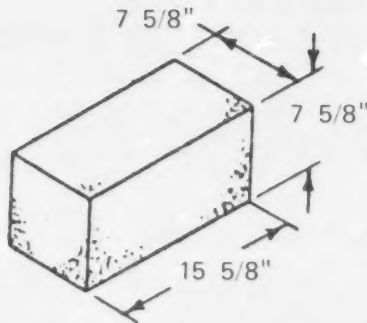
Uses of Structural Clay Tile



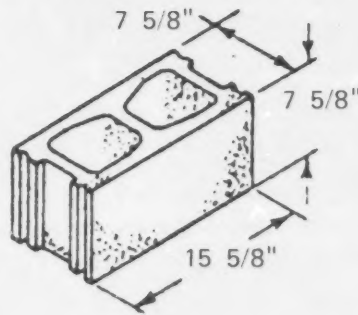
Parts of a Concrete Masonry Unit



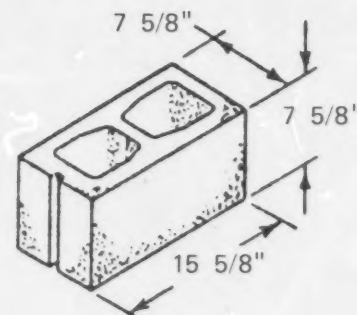
Types of Concrete Masonry Units



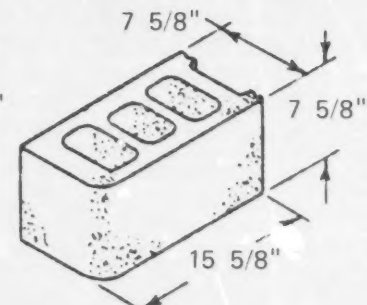
8" Solid



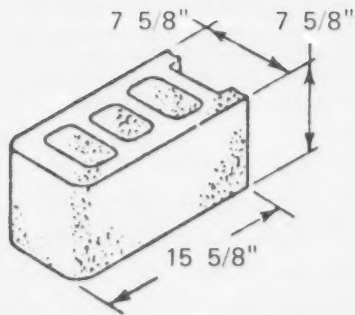
8" Standard



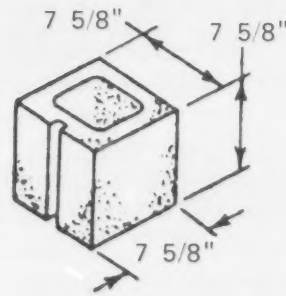
8" Corner sash



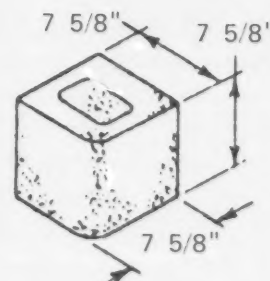
8" Single B.N. 2" R.



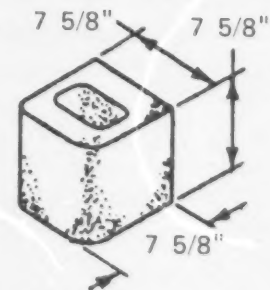
8" Double B.N. 2" R.



8" Half

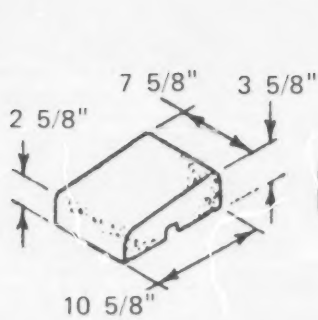


8" Half single B.N. 2" R.

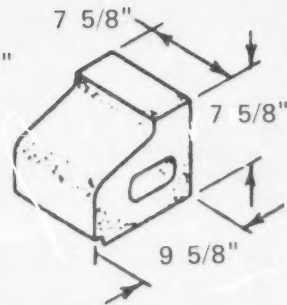


8" Half double B.N. 2" R.

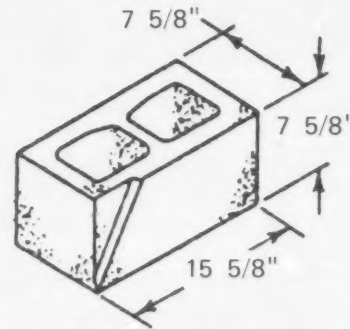
Types of Concrete Masonry Units (Continued)



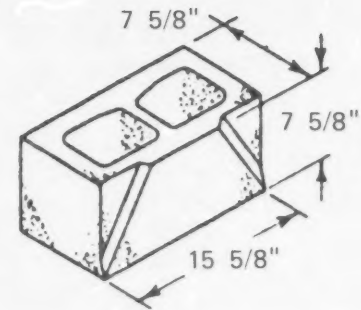
Coping



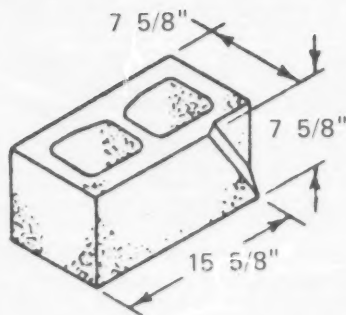
Window sill



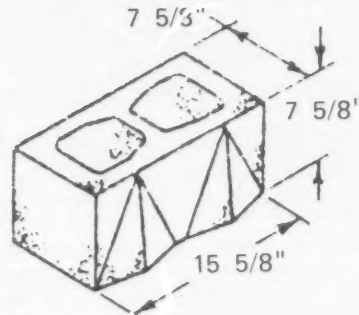
8" Shadowal, right



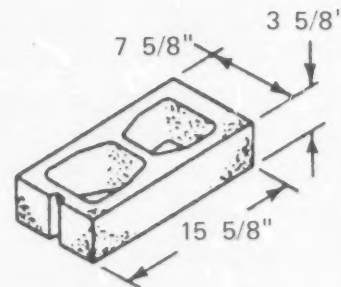
8" Shadowal double bevel



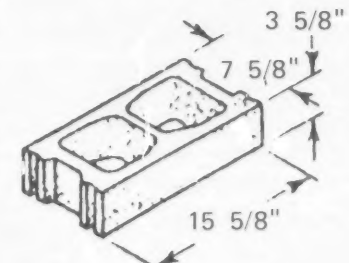
8" Shadowal, left



Lite mark 2

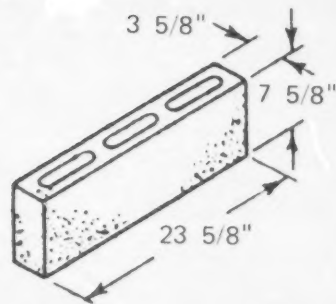
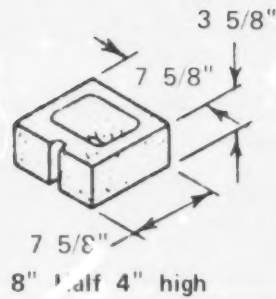


8" Corner 4" high

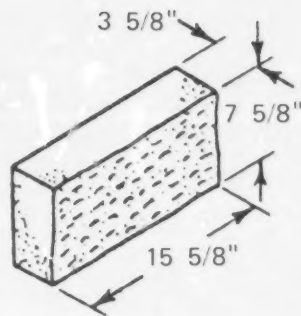


8" Standard 4" high

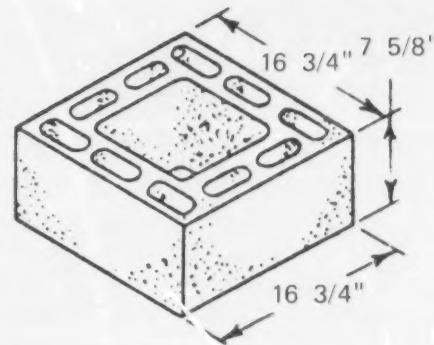
Types of Concrete Masonry Units (Continued)



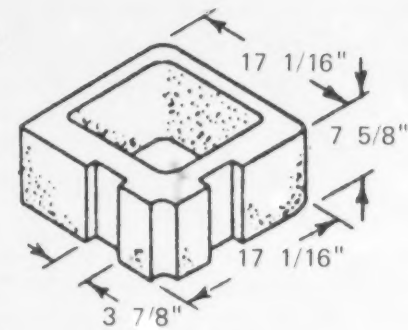
Partition block



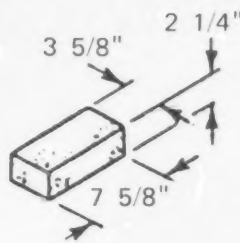
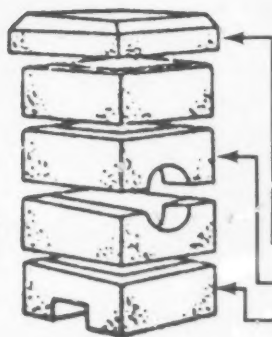
8" Ranch stone



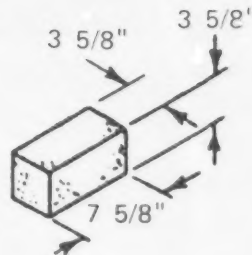
Chimney block



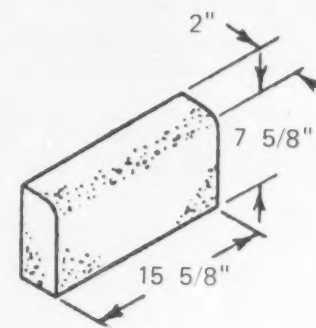
Corner pilaster



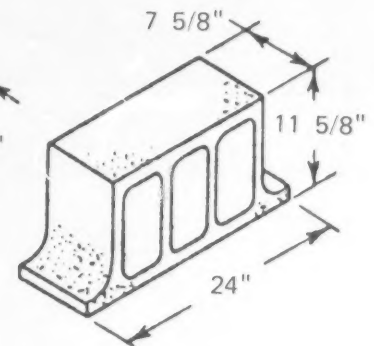
Concrete brick



Jumbo brick



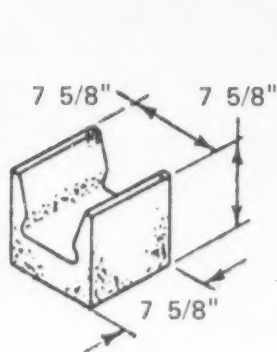
2" B.N. cap or sill



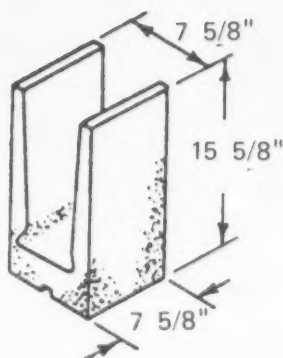
12" Soffit

Types of Concrete Masonry Units

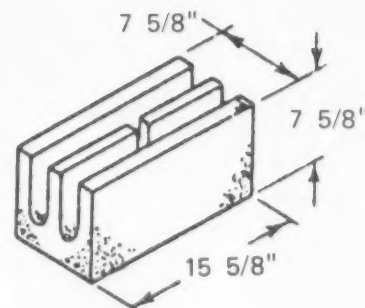
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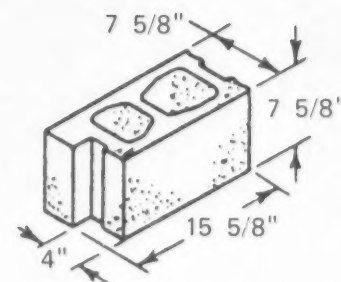
8" Half lintel



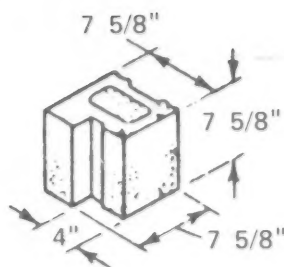
8" Full lintel



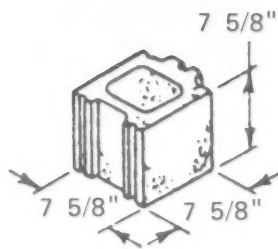
8" Bond beam lintel



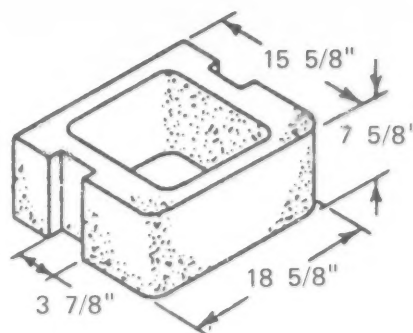
8" Joist



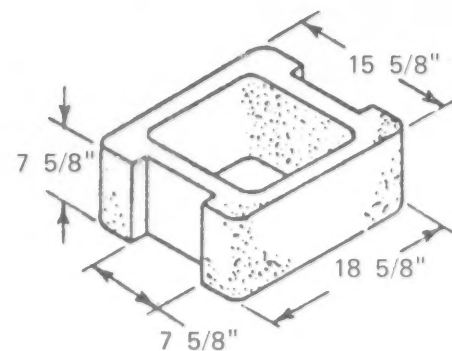
8" Half joist



8" Control joint

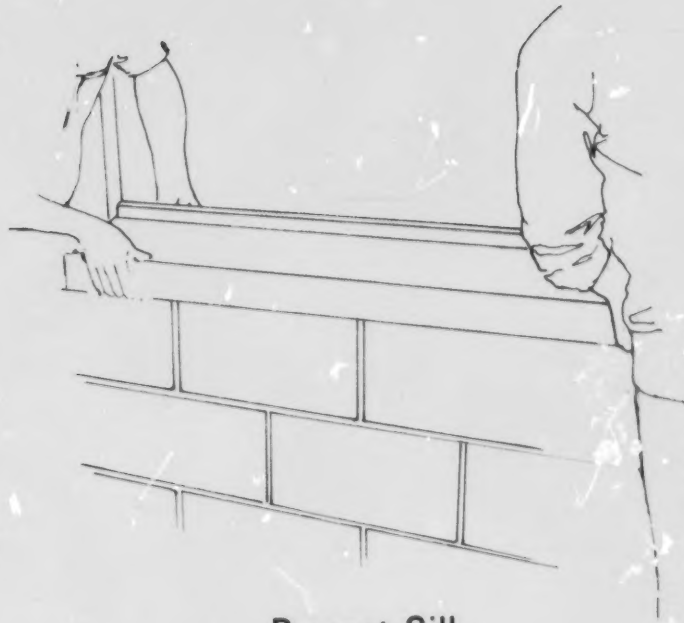


Flush pilaster

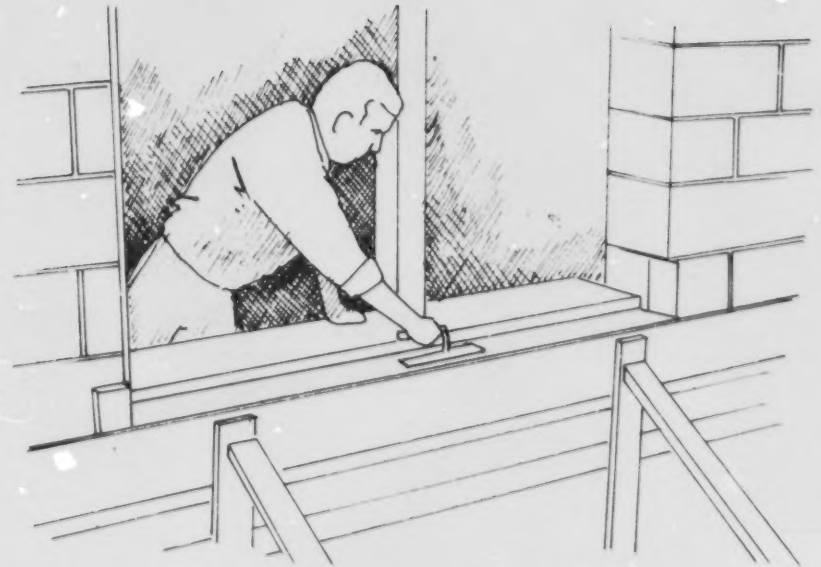


Double B.N. Pilaster

Sills and Lintels



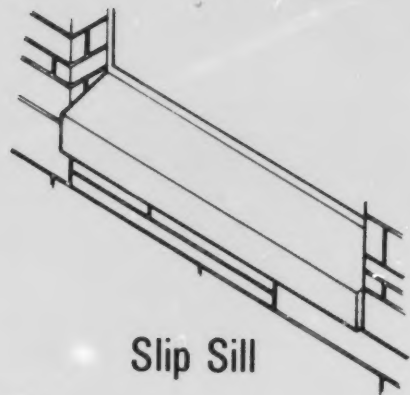
Precast Sill



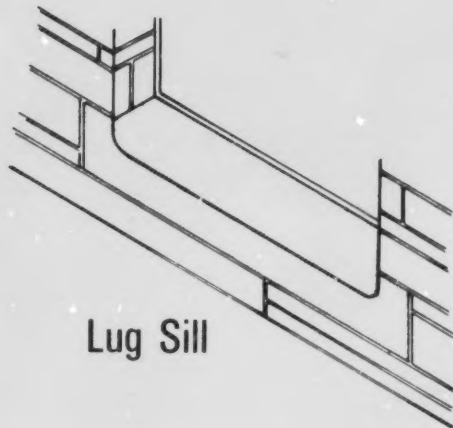
Cast-In-Place Sill

Sills and Lintels

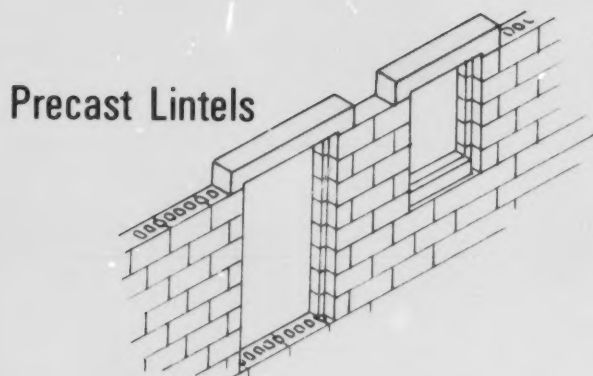
(Continued)



Slip Sill



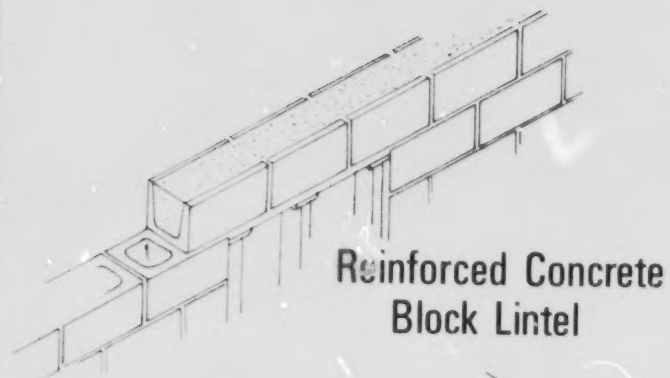
Lug Sill



Precast Lintels

Sills and Lintels

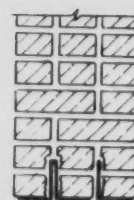
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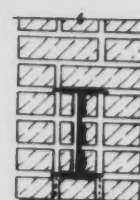
Reinforced Concrete
Block Lintel



2 Angle
Lintel

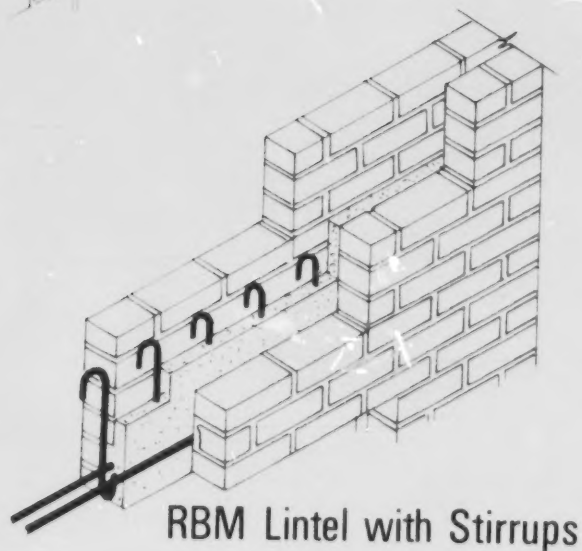


3 Angle
Lintel

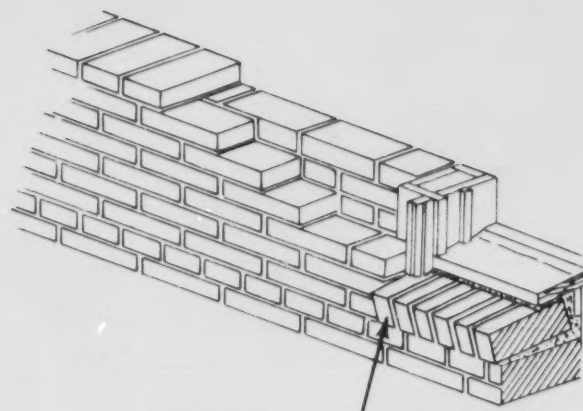


Steel I-Beam and
Suspended Plate

Steel Angle Lintel

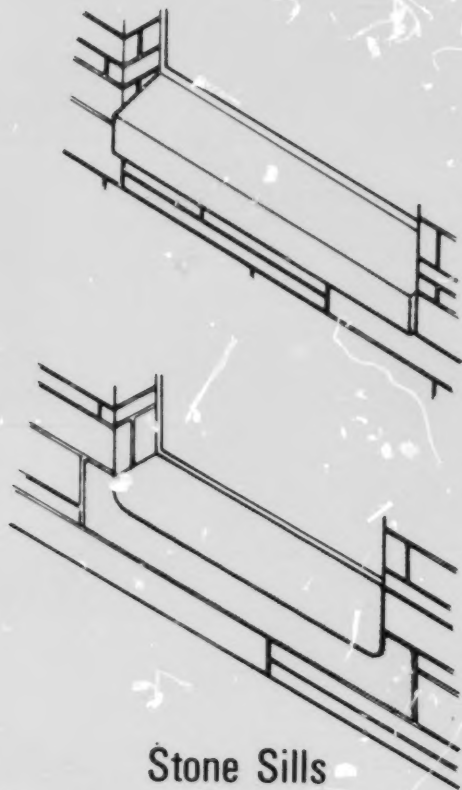


RBM Lintel with Stirrups

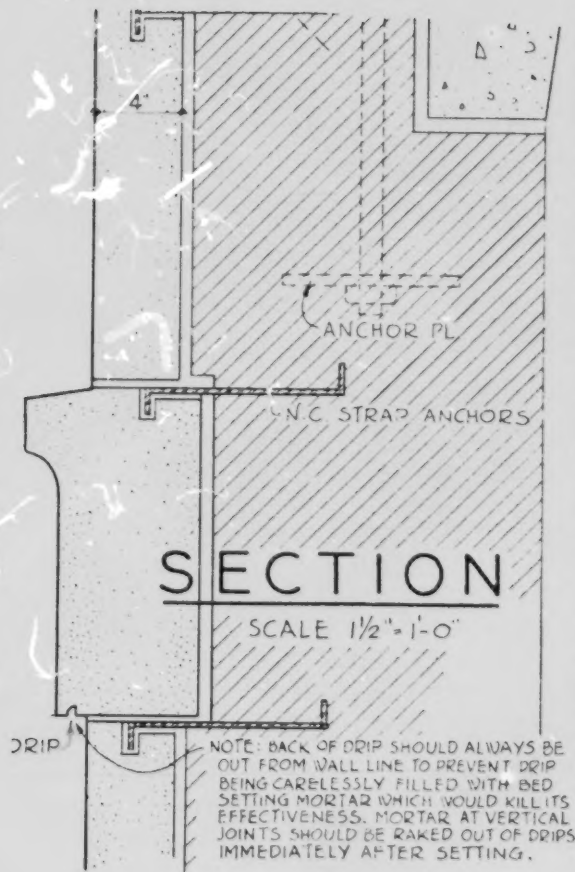


Rowlock Course Tilted

Cut Stone

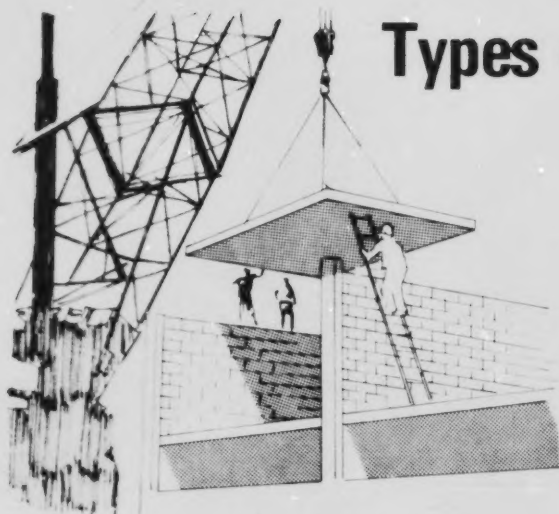


Stone Sills

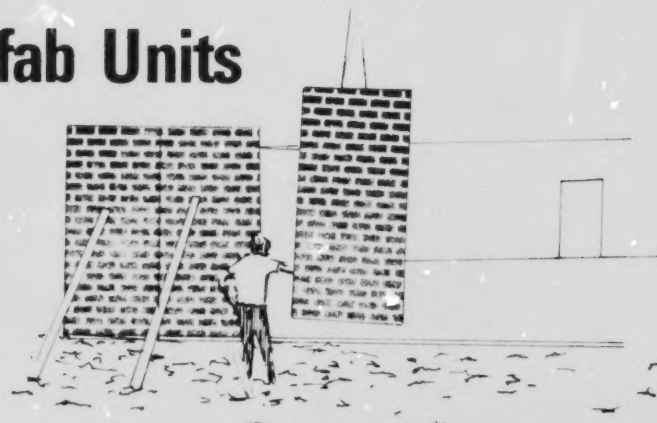


Cut Stone or Dimension Stone

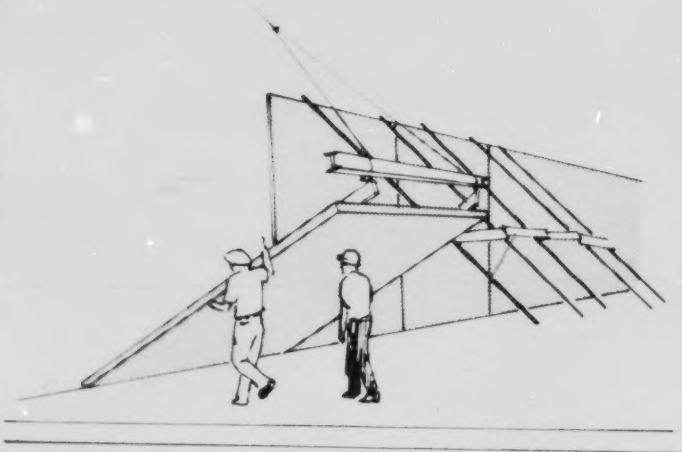
Types of Prefab Units



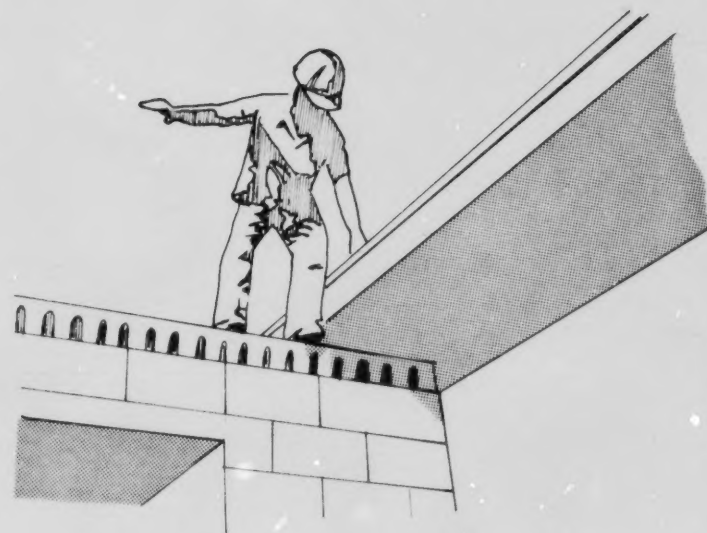
Prefab Roof or Floor Slab



Prefab Brick Panel



Tilt-Up Slab

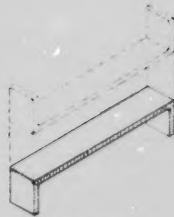


Voided Concrete Plank

Accessories



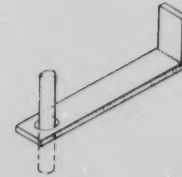
STRAP
ANCHOR



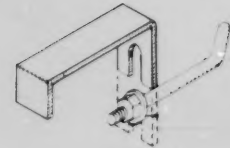
CRAMP
ANCHOR



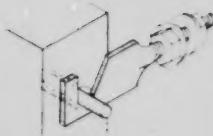
CORRUGATED
WALL TIE



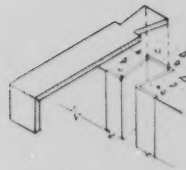
STRAP ANCHOR
AND DOWEL



SLOTTED CRAMP
ANCHOR & WALL BOLT



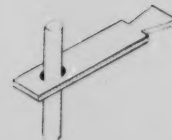
FLATHOOK
WALL TIE TO
STEEL WEB



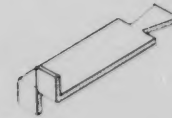
DOVETAIL
ANCHOR & SLOT



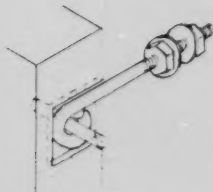
CORRUGATED
DOVETAIL
ANCHOR



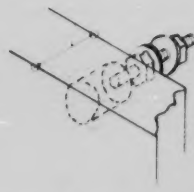
DOVETAIL
ANCHOR
& DOWEL



TWO-WAY
DOVETAIL
ANCHOR



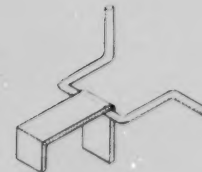
EYE-BOLT TIEBACK
TO STEEL WEB



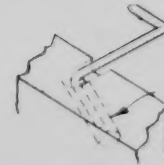
RING WEDGE
ANCHOR TO STEEL



ROD CRAMP
ANCHOR



ANCHOR CLIP
AND LOOP

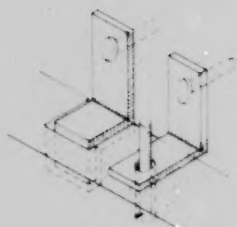


ROD
ANCHOR

Accessories (Continued)



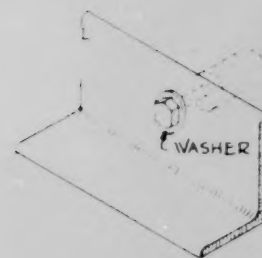
**DOWEL AND
WIRE
ANCHORS**



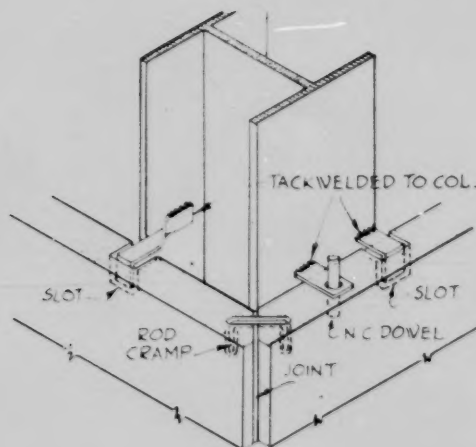
**POWDER STUD
ANCHORS INTO
HARD MASONRY**



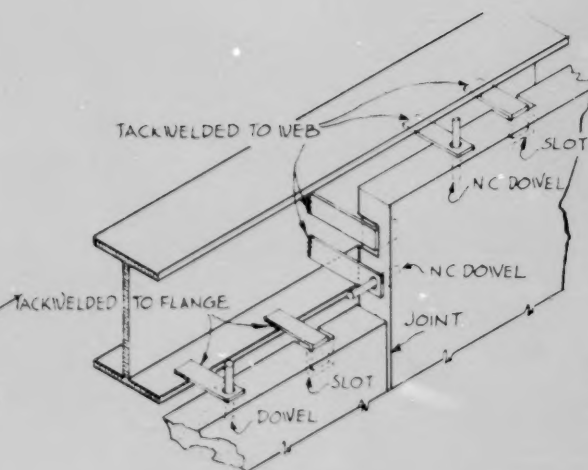
**WELDED BAR
LUGS ON SHELF
ANGLE SUPPORTS**



**RING WEDGE
ANCHOR FOR SHELF
ANGLE SUPPORTS**

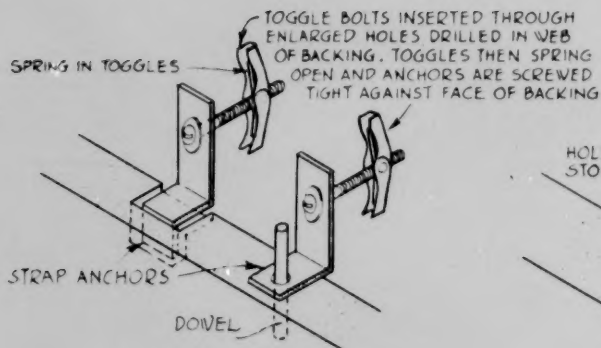


ANCHORING TO STEEL COLUMNS

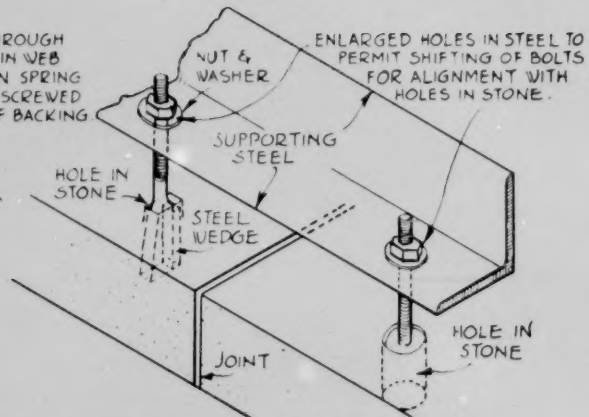


ANCHORING TO STEEL BEAMS

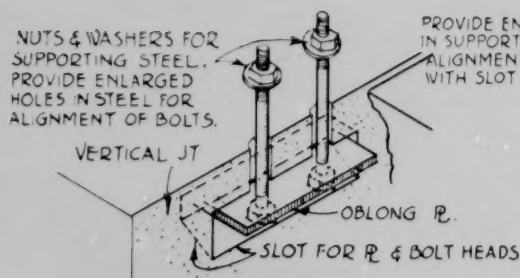
Accessories (Continued)



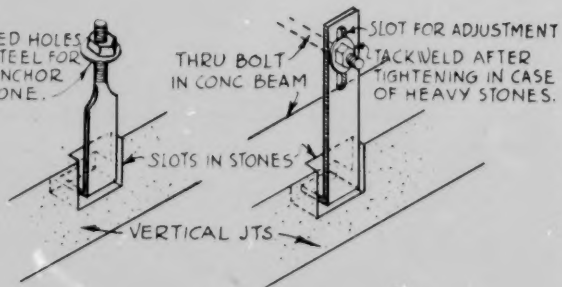
**TOGGLE BOLTS FOR
BLOCK OR TILE WALLS**



**LEWIS BOLT AND RING WEDGE
SOFFIT HANGING**

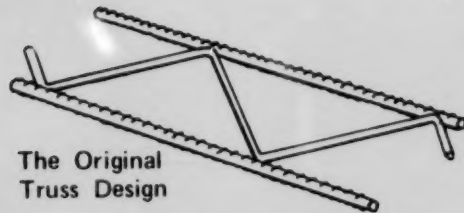


**OBLONG PLATE HANGER
FOR SOFFIT HANGING**

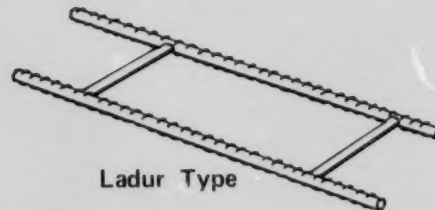


STRAPS FOR SOFFIT HANGING

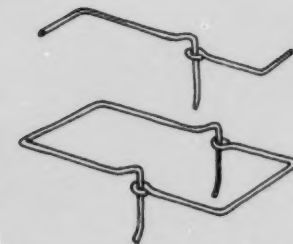
Accessories (Continued)



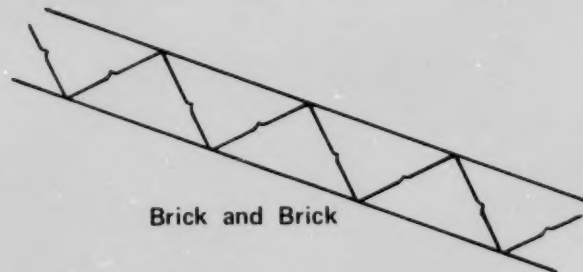
The Original
Truss Design



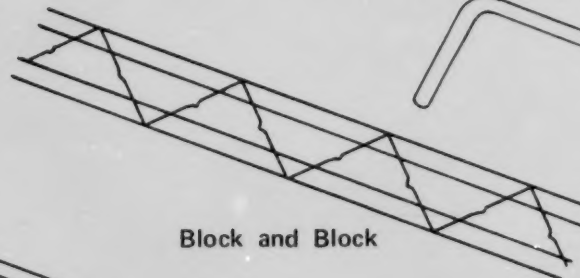
Ladur Type



Adjustable Wall Ties



Brick and Brick



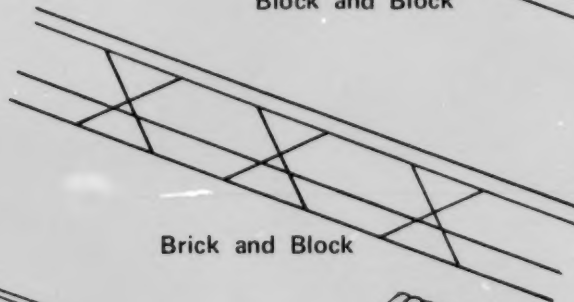
Block and Block



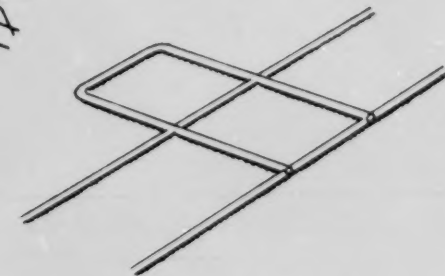
Z Tie Available With
or Without Drip



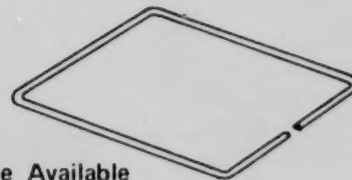
Dovetail Anchor,
7/8 in., 16 Gauge



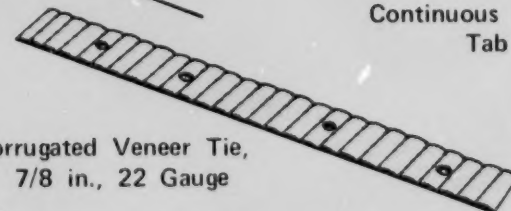
Brick and Block



Continuous Rectangular
Tab Tie



Rectangular Tie Available
With or Without Drip



Corrugated Veneer Tie,
7/8 in., 22 Gauge

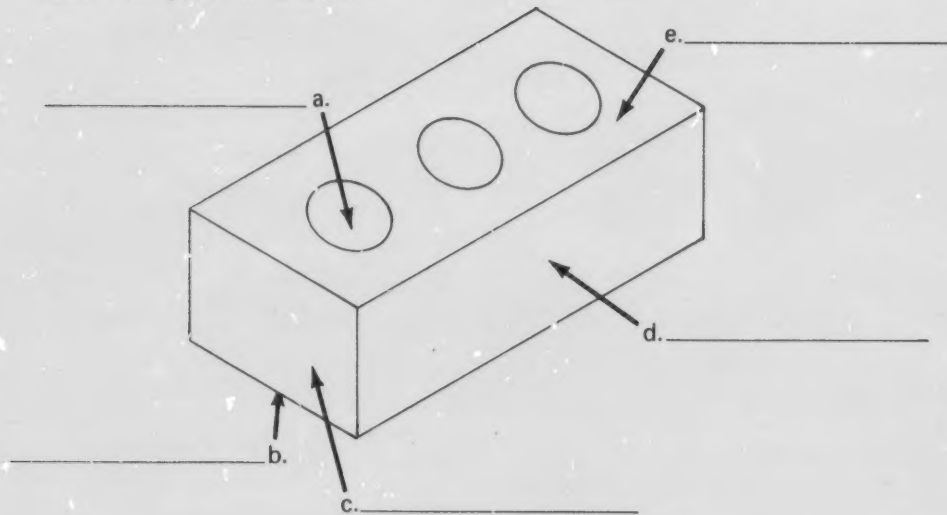
MASONRY UNITS UNIT II

TEST

1. Match the terms on the right to the correct definitions.

- | | |
|---|-------------------|
| _____ a. Masonry construction fabricated in a location other than its final inservice location in the structure | 1. Modular |
| _____ b. Unit that may be cast on job location, such as tilt-up wall or precast panel | 2. Nonmodular |
| _____ c. Beam placed over an opening in a wall | 3. Roman brick |
| _____ d. Unit with nominal dimensions based on the 4-inch module | 4. Norman brick |
| _____ e. Solid masonry unit with nominal dimensions of 2" x 4" x 12" | 5. Standard brick |
| _____ f. Man-made stone; generally made with reinforced concrete | 6. Prefab unit |
| _____ g. Item needed for reinforcement and anchorage of masonry unit | 7. Precast unit |
| _____ h. Brick with nominal dimensions of 2 2/3" x 4" x 12" | 8. Sill |
| _____ i. Variations in thickness of standard brick and oversize brick | 9. Lintel |
| _____ j. Lowest member beneath an opening such as a window or door | 10. Cut stone |
| _____ k. Dimension stone; blocks of stone cut or quarried to be cut to specified dimensions | 11. Cast stone |
| _____ l. Brick with nominal dimensions of 2 1/4" x 3 3/4" x 8" | 12. Refractory |
| _____ m. Brick made of refractory ceramic materials which will resist high temperatures | 13. Accessory |

2. Label the parts of a brick.



3. Name two kinds of brick according to dimensions.

a.

b.

4. Classify the brick named below as to modular or nonmodular by placing an "M" in the blank if it is modular and an "N" in the blank if it is nonmodular.

____ a. Standard

____ b. Engineer

____ c. Double

____ d. Norman

____ e. Three inch

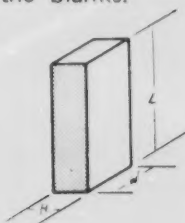
____ f. Economy 12

____ g. Oversize

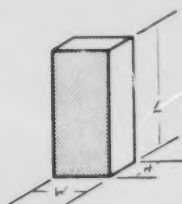
____ h. Roman

____ i. Triple

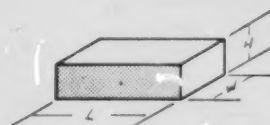
5. Identify brick according to position in the wall by writing the correct names in the blanks.



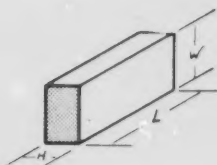
a. _____



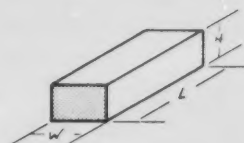
b. _____



c. _____



d. _____



e. _____

6. Describe the effects of absorption of hard and soft brick on mortar and bond.

a. Hard brick

b. Soft brick

7. Name two types of structural clay tile units.

a.

b.

8. List four uses of structural clay tile.

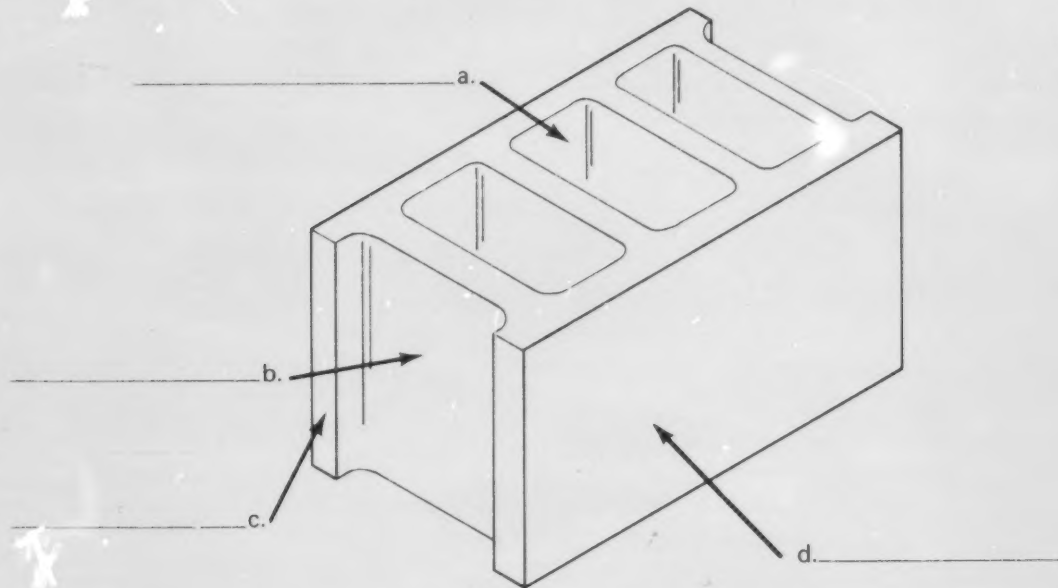
a.

b.

c.

d.

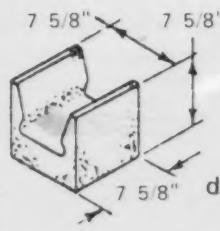
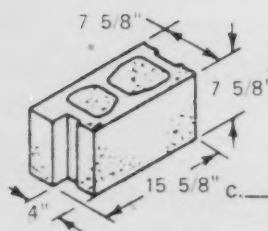
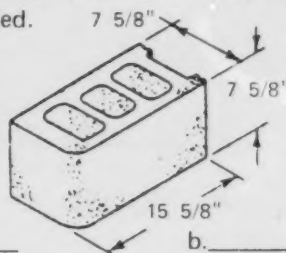
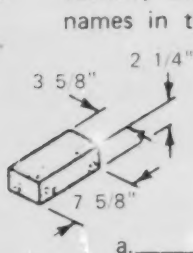
9. Identify the parts of the concrete masonry unit shown below by writing the correct names in the blanks.

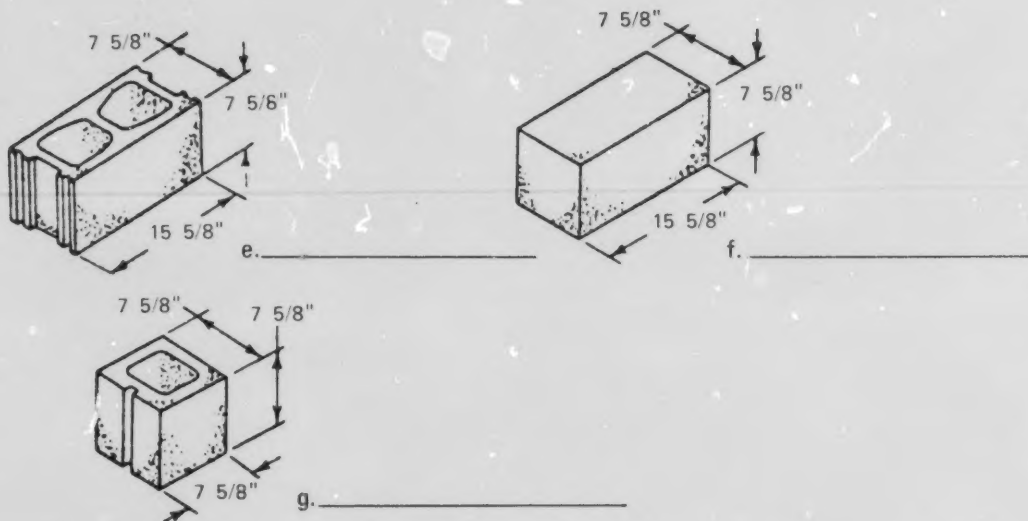


10. Name two types of concrete masonry units.

- a.
b.

11. Identify the shapes of common concrete masonry units by writing the correct names in the blanks provided.





12. Name three kinds of sills and three kinds of lintels.

a. Sills

1)

2)

3)

b. Lintels

1)

2)

3)

13. Name three types of cut stone.

a.

b.

c.

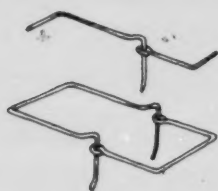
14. List three principle uses of cut stone.

a.

b.

c.

15. Describe the difference between cast and cut stone.
16. Name four principle uses of refractory brick.
- a.
 - b.
 - c.
 - d.
17. Name three principle uses of prefabricated units.
- a.
 - b.
 - c.
18. Identify the following accessories used with masonry units by writing the correct names in the blanks provided.



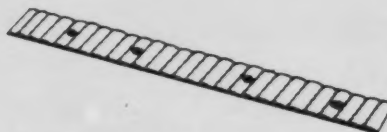
a. _____



b. _____



c. _____



d. _____

19. Name three principle uses of each of the following accessories.

a. Masonry wall reinforcement

1)

2)

3)

b. Metal or wall ties

1)

2)

3)

MASONRY UNITS
UNIT II

ANSWERS TO TEST

- | | | | | | | |
|----|----|---|----|----|----|----|
| 1. | a. | 6 | f. | 11 | k. | 10 |
| | b. | 7 | g. | 13 | l. | 5 |
| | c. | 9 | h. | 4 | m. | 12 |
| | d. | 1 | i. | 2 | | |
| | e. | 3 | j. | 8 | | |
- 2.
- a. Core
 - b. Bottom
 - c. End
 - d. Face
 - e. Top
- 3.
- a. Modular
 - b. Nonmodular
- 4.
- | | | | |
|----|--------|----|---|
| a. | N or M | f. | M |
| b. | M | g. | N |
| c. | M | h. | M |
| d. | M | i. | M |
| e. | N | | |
- 5.
- a. Soldier
 - b. Sailor
 - c. Stretcher
 - d. Rowlock header
 - e. Header

6. Description should include:
 - a. Hard brick
 - 1) Is very dense
 - 2) Has low suction or absorption
 - b. Soft brick
 - 1) Is porous
 - 2) Has high suction or absorption
7.
 - a. Ceramic glaze finish
 - b. Unglazed finish
8. Any four of the following:
 - a. Toilet areas
 - b. Locker rooms
 - c. Meat packing plants
 - d. Stairways
 - e. Load-bearing walls
 - f. Nonload-bearing walls
9.
 - a. Hollow cell or core
 - b. Cross web
 - c. Vertical shell
 - d. Face shell
10.
 - a. Lightweight
 - b. Standard
11.
 - a. Concrete brick
 - b. Bull nose block
 - c. 8" joist

- d. 8" half lintel block
 - e. 8" standard
 - f. 8" solid
 - g. 8" half
12. a. Sills--Any three of the following:
- 1) Slip
 - 2) Lug
 - 3) Precast
 - 4) Cast-in-place
 - 5) Brick
- b. Lintels--Any three of the following:
- 1) Precast
 - 2) Cast-in-place
 - 3) Lintel block
 - 4) Angle iron to receive masonry unit
 - 5) Reinforced brick
13. Any three of the following:
- a. Limestone
 - b. Sandstone
 - c. Granite
 - d. Slate
14. Any three of the following:
- a. Stone trim
 - b. Neat appearance
 - c. Decorative pattern
 - d. Architectural design
 - e. Elaborate buildings

15. Description should include:
 - a. Cast stone--Made with concrete
 - b. Cut stone--Mined from a quarry and cut to size
16.
 - a. High temperature furnaces
 - b. Fireplace firebox
 - c. Acid tanks and other chemical tanks
 - d. High pressure areas
17.
 - a. Walls
 - b. Roofs
 - c. Tilt-up
18.
 - a. Adjustable wall ties
 - b. Dove-tail anchor
 - c. Masonry wall reinforcement
 - d. Corrugated metal tie
19. Any three of the following:
 - a. Masonry wall reinforcement
 - 1) Crack control
 - 2) Tensile wall strength
 - 3) Bonding and reinforcing composite walls
 - 4) Bonding and reinforcing cavity walls
 - b. Metal or wall ties
 - 1) Tying veneer walls to frame or back-up
 - 2) Attaching veneer walls to concrete walls, beams, or columns
 - 3) Cavity walls with rigid insulation
 - 4) Cavity walls with air space or loose insulation
 - 5) Window and door frame

BRICKLAYING PROGRESS CHART

Section D Materials

Student's Name

Job

Unit Test
Mix 1:1:6 Mortar with Mechanical
Mixer
Mix 1:1:6 Mortar by Hand Using
Mortar Box
Unit Test

Unit I
Mortars

Unit II
Masonry
Units

1

2

3

1

1

2

3

4

5

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8



JOB ADVANCEMENT UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list characteristics employers consider in deciding whom to promote and discuss steps that will help in job advancement. The student should be able to name sources of additional education and training and develop a program for self-improvement. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with job advancement to the correct definitions.
2. List characteristics employers consider in deciding whom to promote.
3. Distinguish between ways good and poor attitudes show through on a job.
4. Discuss steps that will help in job advancement.
5. Select from a list benefits of additional education and training.
6. Name sources of additional education and training.
7. Discuss activities and/or commitments that will better prepare a person for advancement and responsibility.
8. Discuss reasons people cannot succeed on a job.
9. Develop a program for self-improvement.

JOB ADVANCEMENT UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Discuss terminal and specific objectives.
- D. Discuss information and assignment sheets.
- E. Invite a personnel officer to speak to the class about human relations.
- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Complete activities on assignment sheet.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Assignment Sheet #1--Develop a Program for Self-Improvement
- D. Test
- E. Answers to test

II. References:

- A. *You and Your Job: How to Keep It*. Chicago: J. G. Ferguson Publishing Co., 1968.

- B. *You and Your Job: Where Do You Go From Here?* Chicago: J. G. Ferguson Publishing Co., 1968.
- C. Whitcomb, Helen, and Lang, R. *Charm*. Dallas: Gregg Div./McGraw-Hill Book Co., 1964.
- D. Agnew, Peter L.; Meehan, James R.; and Pasewark, William R. *Clerical Office Practice*. 4th ed. Cincinnati: South-Western Publishing Co., 1967.
- E. Kimbrell, Grady, and Vineyard, Ben S. *Succeeding in the World of Work*. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1970.
- F. Frakes, John C.; Archer, Fred; and Brecker, Raymond. *General Office Practice*. 2d ed. Dallas: Gregg Div./McGraw-Hill Book Co., 1966.

JOB ADVANCEMENT
UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Adaptability--Ability to adjust easily to new situations
- B. Cooperativeness--Ability to work with others toward a desired goal
- C. Goodwill--Feeling of rapport and respect that has been established between individuals
- D. Initiative--Act of being a self-starter; finding things that need to be done without having to be told
- E. Perseverance--Action of following a job through to completion
- F. Seniority--Status attained by length of continuous service

II. Characteristics employers consider in deciding whom to promote

(NOTE: These are not listed in order of importance.)

- A. Attitude
- B. Seniority
- C. Knowledge of present job
- D. Quality of work
- E. Quantity of work
- F. Initiative
- G. Perseverance
- H. Cooperativeness
- I. Goodwill
- J. Adaptability
- K. Ability to think
- L. Adequacy of training

INFORMATION SHEET

III. Ways attitudes show through on a job

A. Good attitudes

1. Punctual
2. Dependable
3. Sincere
4. Loyal
5. Quality of work
6. Quantity of work
7. Pride in job
8. Cooperative
9. Aggressive
10. Organized

B. Poor attitudes

1. Loafing
2. Gossiping
3. Using company time for personal activities
4. Doing sloppy work
5. Being late for work

IV. Steps that will help in job advancement

A. Master present job completely

1. Follow directions
2. Ask questions when unsure
3. Follow standard practices
4. Meet deadlines
5. Keep standards high
6. Check quality of work

INFORMATION SHEET

B. Develop a program for self-improvement (Assignment Sheet #1)

1. Improve personality
2. Increase skills
3. Continue education

C. Show initiative on the job

1. Take on additional responsibilities
2. Handle more complicated work
3. Suggest improvements

(NOTE: Do not be overly ambitious at the expense of a more qualified person.)

V. Benefits of additional education and training

- A. Advancement and job stability
- B. Better pay
- C. More exciting and challenging position
- D. Increased responsibilities
- E. Prestige
- F. Personal satisfaction

VI. Sources of additional education and training

- A. Postsecondary courses or classes
- B. Specialized courses
- C. Seminars for advanced training
- D. Colleges, junior colleges, and universities
- E. Adult education centers
- F. Local, state, and national conventions

VII. Activities and commitments in preparation for advancement and responsibility

- A. Reading

INFORMATION SHEET

1. To improve general knowledge
2. To improve communication
3. To enlarge areas of interest
4. To keep up-to-date in the field

B. Joining professional organizations

C. Being active in civic and community projects

VIII. Reasons people cannot succeed on jobs

A. Unable to get along with fellow employees

B. Unskilled

C. Irresponsible

D. Not dependable

E. No initiative

(NOTE: Instructor may want to add others that are common to the community.)

JOB ADVANCEMENT UNIT I

ASSIGNMENT SHEET #1--DEVELOP A PROGRAM FOR SELF-IMPROVEMENT

A professional worker cannot afford to discontinue his/her educational pursuits after high school graduation. He/she must constantly be working to improve own personality and skills. The professional worker has the responsibility to keep abreast in the field so that he/she will be able to suggest ways to reduce costs, increase efficiency, and stimulate profits. The good worker must develop a plan for self-improvement.

Hints to remember in setting up your plan:

Select only a few items to work on at first; add additional items later as your schedule permits.

Set aside a certain time of the week for study and improvement. Do not be tempted to skip your improvement sessions.

Keep your plans simple enough that they do not interfere with your job by making you tired and sluggish.

Visit the public library often to review new books and periodicals.

Compare notes with friends who are working on similar plans.

Check into courses offered at local schools or universities.

Try to learn from others.

Finish each program that you start.

Directions: Complete the following questions.

1. In what personal areas are you weak? Grooming? Voice? Personality? List those areas in which you need improvement.
2. What skills do you have that need improvement? List them below.

ASSIGNMENT SHEET #1

3. Do you consistently try to improve your skills?
4. Do you do additional reading in those areas in which you are interested?
5. How many hours do you spend watching television per week (approximately)?
6. Could you devote one-third of this time to self-improvement?

Procedures for making your plan for self-improvement:

1. Record, on a separate sheet of paper, how you spend your time each day for a week.
2. Review the way you spend your time.
3. List the hours that you plan to spend during the week for self-improvement.
4. List three immediate goals you hope to achieve.
 - a.
 - b.
 - c.
5. Outline your self-improvement plan for the next month using the space below.

ASSIGNMENT SHEET #1

6. After one month of working on your individual improvement plan, review the results. What have you achieved? What had you hoped to achieve that you did not?
7. List the times you let something else take precedence over your self-improvement program.

JOB ADVANCEMENT
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

_____ a. Act of being a self-starter; finding things that need to be done without having to be told	1. Adaptability
_____ b. Ability to work with others toward a desired goal	2. Cooperativeness
_____ c. Feeling of rapport and respect that has been established between individuals	3. Goodwill
_____ d. Action of following a job through to completion	4. Initiative
_____ e. Status attained by length of continuous service	5. Perseverance
_____ f. Ability to adjust easily to new situations	6. Seniority

2. List five characteristics employers consider in deciding whom to promote.

- a.
- b.
- c.
- d.
- e.

3. Distinguish between ways good and poor attitudes show through on a job by placing a "G" in front of statements that show good attitudes and a "P" in front of statements that show poor attitudes.

- _____ a. Punctual
- _____ b. Loafing
- _____ c. Gossiping
- _____ d. Dependable

- ☐ e. Sincere
- ☐ f. Doing sloppy work
- ☐ g. Loyal
- ☐ h. Using company time for personal activities
- ☐ i. Pride in job
- ☐ j. Aggressive
- ☐ k. Organized
- ☐ l. Being late for work

4. Discuss steps that will help in job advancement.

5. Select from the list below benefits of additional education and training by placing an "X" in the blanks.

- ☐ a. Better pay
- ☐ b. College degree
- ☐ c. Prestige
- ☐ d. Advancement and job stability
- ☐ e. Personal satisfaction
- ☐ f. Increased responsibilities

6. Name four sources of additional education and training.
 - a.
 - b.
 - c.
 - d.
7. Discuss three activities and/or commitments that will better prepare a person for advancement and responsibility.
8. Discuss in a short paragraph reasons people cannot succeed on a job.
9. Develop a program for self-improvement.

(NOTE: If this has not been accomplished prior to the test, ask the instructor when the above activity should be completed.)

JOB ADVANCEMENT
UNIT I

ANSWERS TO TEST

1. a. 4 d. 5
 b. 2 e. 6
 c. 3 f. 1
2. Any five of the following:
 - a. Attitude
 - b. Seniority
 - c. Knowledge of present job
 - d. Quality of work
 - e. Quantity of work
 - f. Initiative
 - g. Perseverance
 - h. Cooperativeness
 - i. Goodwill
 - j. Adaptability
 - k. Ability to think
 - l. Adequacy of training
3. a. G g. G
 b. P h. P
 c. P i. G
 d. G j. G
 e. G k. G
 f. P l. P

4. Discussion should include:
 - a. Master present job completely
 - 1) Follow directions
 - 2) Ask questions when unsure
 - 3) Follow standard practices
 - 4) Meet deadlines
 - 5) Keep standards high
 - 6) Check quality of work
 - b. Develop a program for self-improvement
 - 1) Improve personality
 - 2) Increase skills
 - 3) Continue education
 - c. Show initiative on the job
 - 1) Take on additional responsibilities
 - 2) Handle more complicated work
 - 3) Suggest improvements
5. a, c, d, e, f
6. Any four of the following:
 - a. Postsecondary courses or classes
 - b. Specialized courses
 - c. Seminars for advanced training
 - d. Colleges, junior colleges, and universities
 - e. Adult education centers
 - f. Local, state, and national conventions
7. Discussion should include:
 - a. Reading
 - 1) To improve general knowledge

- 2) To improve communication
- 3) To enlarge areas of interest
- 4) To keep up-to-date in the field
- b. Joining professional organizations
- c. Being active in civic and community projects
8. Discussion should include:
 - a. Unable to get along with fellow employees
 - b. Unskilled
 - c. Irresponsible
 - d. Not dependable
 - e. No initiative
 - f. Others as added by instructor
9. Evaluated to the satisfaction of the instructor

FREE ENTERPRISE SYSTEM UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list areas of government involvement in the marketplace. The student should also be able to discuss the free enterprise system, problems with government involvement, and ways prices influence the economy. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with the free enterprise system to the correct definitions.
2. List resources necessary for production of goods and services.
3. Match economic goals of American people to statements describing each goal.
4. List the roles of the government in the economy.
5. Discuss the roles of individuals and businesses in the economy.
6. Describe the function of supply and demand schedules.
7. List the factors that determine the degree of elasticity of demand.
8. Select from a list the ways prices influence the economy.
9. List the benefits of competition and profit.
10. Discuss the characteristics of our modified free enterprise system.
11. Describe ways the government has become involved in the marketplace.
12. List reasons that the government's role has increased.
13. Discuss problems with government involvement in the economy.
14. Select from a list the reasons for striving to reach economic goals.

FREE ENTERPRISE SYSTEM
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.

(NOTE: Instructors may want to bring in a resource person to assist with this unit. Provide the resource person with a copy of the unit.)

- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Circular Flow Between Producers and the Public
 - 2. TM 2--USA vs USSR Comparative Standard of Living
 - 3. TM 3--USA vs USSR Comparative Standard of Living (Continued)
 - 4. TM 4--Alternate Uses for Scarce Land

5. TM 5--Alternate Uses for Scarce Capital
6. TM 6--Alternate Uses for Scarce Manpower
7. TM 7--Desire for Stability vs Desire for Freedom
8. TM 8--Desire for Security vs Desire for Efficiency
9. TM 9--Desire for Growth vs Desire for Justice
10. TM 10--Circular Flow Between Government and the Public
11. TM 11--Supply and Demand Schedule
12. TM 12--Supply and Demand Curves
13. TM 13--Ways Prices Influence the Economy
14. TM 14--Helping Growth
15. TM 15--Limiting Growth

D. Test

F. Answers to test

II. References:

- A. Calderwood, James D., and Fersh, George L. *Economics for Decision Making*. New York: Macmillan Publishing Co., Inc., 1974.
- B. Nelson, Frank W. *Distributive Education II: Course of Study*. Stillwater: Oklahoma State Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center, 1976.

FREE ENTERPRISE SYSTEM
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Economics--Study of how persons can best consume, produce, and distribute goods and services to try to satisfy their never-ending and ever-increasing wants
- B. Free enterprise--System where most production is done by privately owned corporations, partnerships, and private citizens in a free market

(NOTE: Free enterprise is sometimes referred to as *private enterprise*.)

- C. Demand--Amount of a good or service wanted at a given price and time
- D. Supply--Amount of a good or service that will be offered for sale at a given price and time
- E. Elasticity--How much the demand for a good or service will increase if the price is lowered or how much the demand will decrease if the price is raised

Example: If the price of cars were cut by 50%, the demand probably would increase greatly

- F. Inelasticity--Condition where demand is not affected much by a change in price

Example: If the price of salt were cut by 50%, the demand would not increase very much

- G. Product market--System where goods and services are sold by producers to consumers who in turn pay money to the producers for these goods and services (Transparency 1)
- H. Factor market--System where the factors of production (labor, management, property, and savings) flow from the public to the producers and where money payments (wages, salaries, interest, rent, and dividends) flow from the producers back to the public (Transparency 1)

- I. Communism--Economic and political system where the government leaders try to achieve equality by controlling all property and production and by deciding how and to whom goods and services are distributed

Examples: USSR, China

INFORMATION SHEET

- J. Capitalism--Economic and political system characterized by elected representatives, limited government control, and freedoms such as freedom of speech, the right to own property, the right to choose a job, and freedom of religion (Transparencies 2 and 3)

(NOTE: The term *capitalism* is often used interchangeably with the term *free enterprise* or *private enterprise*.)

- K. Socialism--Economic and political system where the government controls most means of production

Example: Great Britain

- L. Assets--Property owned by or due a business

Examples: Cash, accounts receivable, inventory, building, patents

- M. Liabilities--All claims against a corporation or entity

Examples: Salaries, dividends, taxes, mortgages, loans

- N. Natural resources--Materials supplied by nature

Examples: Land, water, lumber, minerals, fuel

- O. Labor--Services performed by people with skills for wages

- P. Capital--Accumulated goods designed to bring in income

Examples: Tools, machines, buildings

- Q. Management--Skill to direct and control other resources

- R. Technology--Ability to produce more goods and services with fewer resources

- S. Entrepreneur--Person who organizes and manages a business, assuming the risk for the sake of profit

- II. Resources necessary for production of goods and services (Transparencies 4, 5, and 6)

A. Capital

B. Management

C. Labor

D. Natural resources

INFORMATION SHEET

III. Economic goals of American people (Transparencies 7, 8, and 9)

- A. Economic efficiency--Getting the most of time, energy, money, and abilities
- B. Economic growth--Obtaining better education, highways, hospitals, postal service, fire and police protection, and recreational facilities for all Americans
- C. Economic stability--Avoiding recessions, depressions, and inflation
- D. Economic security--Protecting against risks people run into in their daily lives
- E. Economic freedom--Going into business to produce whatever goods and services a person thinks he/she can sell at a profit

(NOTE: This also includes the freedom to leave a business.)

- F. Economic justice--Applying economic policies to the ideas about what is right and wrong

Examples: Minimum wage laws; individuals being financially able to support churches and other charitable organizations

(NOTE: Goals may conflict. Therefore, Americans must try to achieve the best combination or "mix" of these goals. It is the privilege and responsibility of all Americans to know the issues, vote on bills, and elect officials at all levels of government who will help achieve these goals.)

IV. Roles of the government in the economy (Transparency 10)

- A. Producer and consumer

(NOTE: Federal, state, and local governments are the biggest businesses in the country.)

Examples: Government hires workers, buys raw materials, produces postal services, establishes universities, runs hospitals, provides police and fire protection, and collects taxes to pay for the production costs

- B. Regulator and protector

(NOTE: The government in this role sets rules for banks and advertising; pollution controls; building codes; food, drug, and cosmetic standards; and utility rates and enforces wage and age requirements for employment.)

- C. Promoter of economic goals of American people

INFORMATION SHEET

- V. Role of individuals and businesses in the economy (Transparency 1)
- A. Individuals and businesses save money
 - B. Savings are then invested in machines, tools, factories, stores, and offices
 - C. Labor works to produce goods and services for itself and others
 - D. Businesses provide wages, salaries, and stock dividends with which individuals can save and/or purchase goods and services
- VI. Function of supply and demand schedules-To determine price and quantity of good or service (Transparencies 11 and 12)
- (NOTE: Demand and supply are the totals of individual decisions of millions of buyers and sellers.)
- VII. Factors that determine the degree of elasticity of demand (Transparencies 11 and 12)
- A. Whether a good or service is a necessity or luxury
- (NOTE: Luxuries are more elastic than necessities. Thus, more luxury items would usually be demanded at lower prices.)
- B. Availability and price of substitute products
- Example: Oleo may be substituted for butter. If the price of butter goes down, people might buy more butter and less oleo
- C. Amount of money people are willing and able to spend
- VIII. Ways prices influence the economy (Transparency 13)
- A. Prices determine what will be produced by showing what is profitable and not profitable to sell
 - B. Prices determine how scarce resources will be used
 - C. Prices determine whether a substitute can be used
- Example: If the consumers have no preference, an item made from plastic can be substituted for one made from glass in order to reduce the cost of production
- D. Prices determine who can afford certain goods and services

INFORMATION SHEET

- E. Individual decisions are influenced by prices

Example: Price changes influence buying and selling habits and occupational decisions

- F. People collectively determine prices by what they are willing to buy

(NOTE: This is known as *economic vote*.)

- G. Producers try to learn how consumers will "vote" or purchase goods and services by studying past sales records and by conducting marketing studies

IX. Benefits of competition and profit

- A. Stimulates the development of new or improved goods and services

- B. Causes scarce resources to be used as efficiently as possible

- C. Reduces prices

- D. Motivates people to open new businesses

- E. Creates new jobs

(NOTE: No profit = No capital = No tools = No jobs.)

- F. Encourages more effective selling and promotion techniques

(NOTE: The average net profit, after taxes, in retailing is four percent or four cents out of every dollar of sales. The average return on investment for all industries is about eleven percent. Profits may be used to invest in new equipment, pay dividends, conduct research, and support educational and charitable organizations.)

X. Characteristics of our modified free enterprise system

- A. Permits local, state, and federal governments to play a role in how resources will be used

- B. Allows some monopolies to exist

Example: Telephone companies

- C. Has profit motive as main incentive

- D. Maintains efficiency through competition in the marketplace

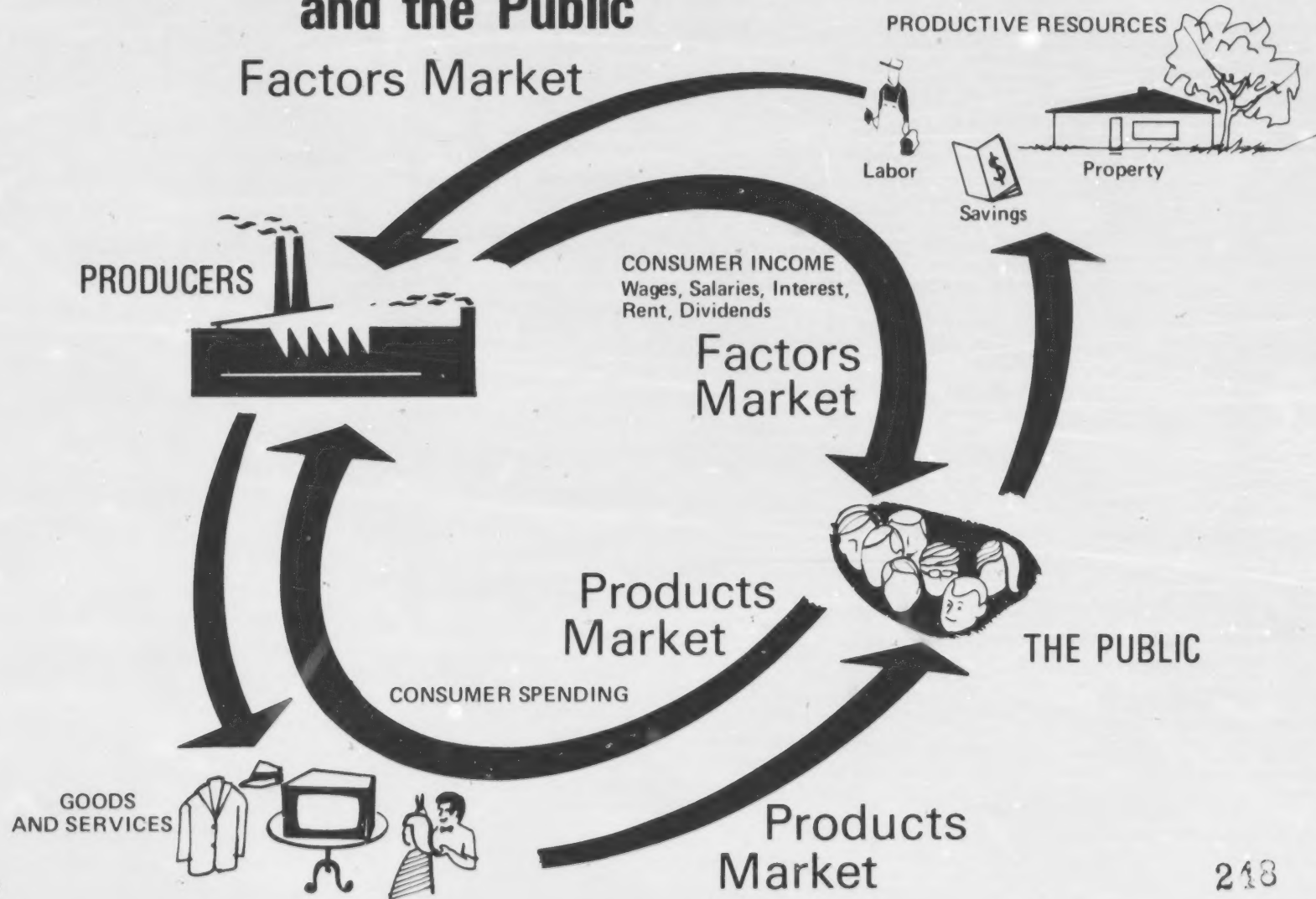
INFORMATION SHEET

- E. Determines kinds and levels of production mainly by consumer purchases
 - F. Provides rights to own property, to enter or leave a job, and to make contracts
- XI. Ways the government has become involved in the marketplace
- A. Floor (minimum) and ceiling (maximum) boundaries set on wages and prices
(NOTE: Boundaries may effect unemployment.)
 - B. Regulations on public utilities
Examples: Airlines, railroads, telephone companies, and gas and electricity rates
 - C. Tariffs on imports to encourage the sale of American goods
- XII. Reasons government's role has increased
- A. Larger populations and movement to large cities require more goods and services
Examples: Sewers, street lights, garbage trucks, health regulations
(NOTE: Such services are often necessary before industry will locate in a city.)
 - B. Need for national defense has increased
 - C. Desire for justice
 - D. Desire for economic security
- XIII. Problems with government involvement in the economy
- A. Government is not as efficient as private business
 - 1. Government agencies do not have to use resources wisely in order to make a profit or to compete
 - 2. Civil service safeguards lessen the influence of politics on government employees but may make it difficult to fire the few people who may not do a job well
 - B. People often lose certain freedoms of choice

INFORMATION SHEET

- XIV. Reasons for striving to reach economic goals (Transparencies 14 and 15)
- A. Raise the standard of living for more people
 - B. Have full employment
 - C. Compete in the international market with countries such as Japan and Germany
 - D. Meet the challenge of Communism to replace the United States as the world's leading power
 - E. Provide assistance and guidance to developing countries

Circular Flow Between Producers and the Public



USA vs USSR Comparative Standard of Living

Approximate worktime required to buy commodities at state-fixed prices in Moscow and at retail stores in New York City, July 1, 1970:

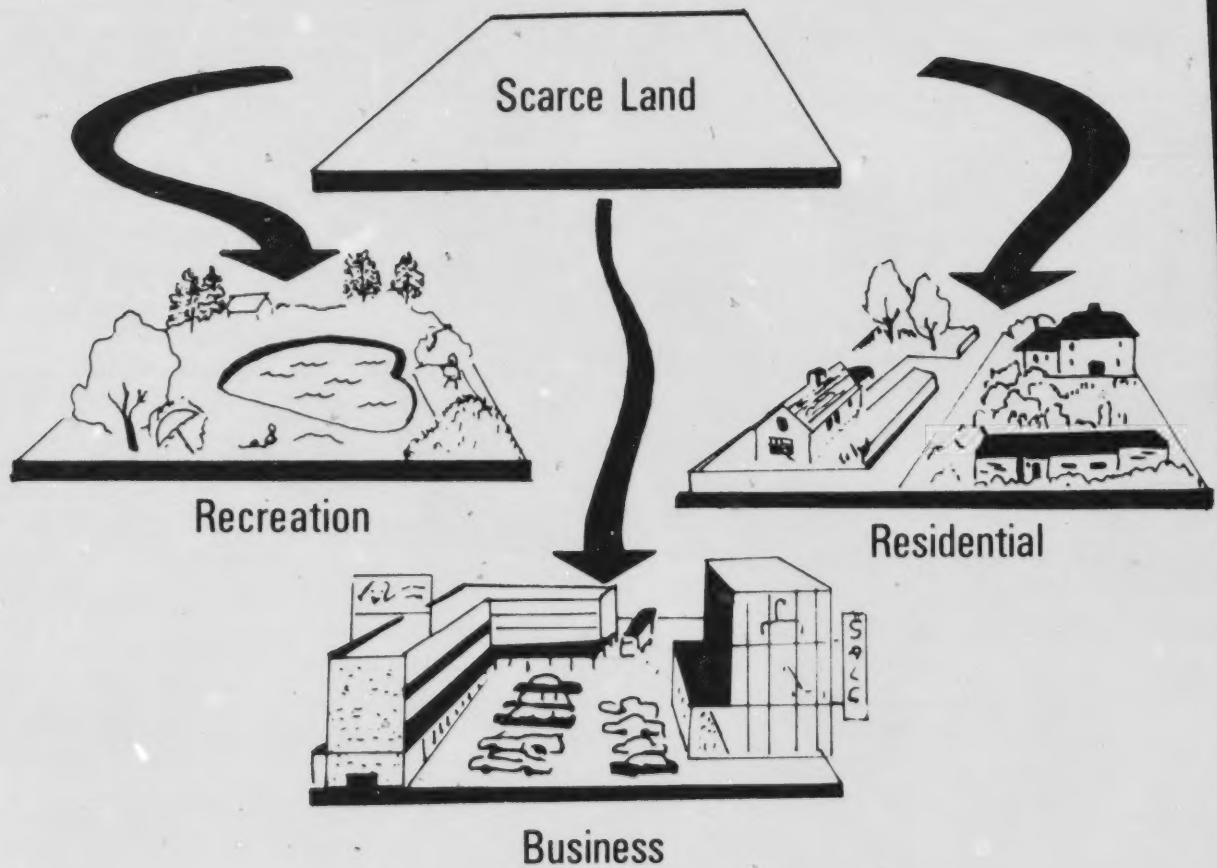
Commodity	New York City	Moscow
White bread (1 lb.)	5 minutes	17 minutes
Potatoes (1 lb.)	2 minutes	4 minutes
Beef, rib roast (1 lb.)	41 minutes	137 minutes
Butter (1 lb.)	16 minutes	140 minutes
Sugar (1 lb.)	3 minutes	45 minutes
Milk (1 qt.)	6 minutes	24 minutes
Eggs (1 doz.)	12 minutes	93 minutes
Men's cotton shirt	1.7 hours	11.4 hours
Men's suit, wool, single-breasted, medium price range	26.3 hours	157.0 hours
Men's shoes, leather oxfords	6.0 hours	35.0 hours
Women's dress	5.6 hours	42.0 hours
Women's shoes, leather oxfords, medium price range	5.3 hours	33.0 hours
Women's nylon stockings	17.5 minutes	2.9 hours
Toilet soap (3 1/2 ounce)	2.0 minutes	16.3 minutes
Cigarettes, non-filter, regulars	8.5 minutes	15.1 minutes
Vodka (fifth)	1.2 minutes	4.4 hours

USA vs USSR Comparative Standard of Living

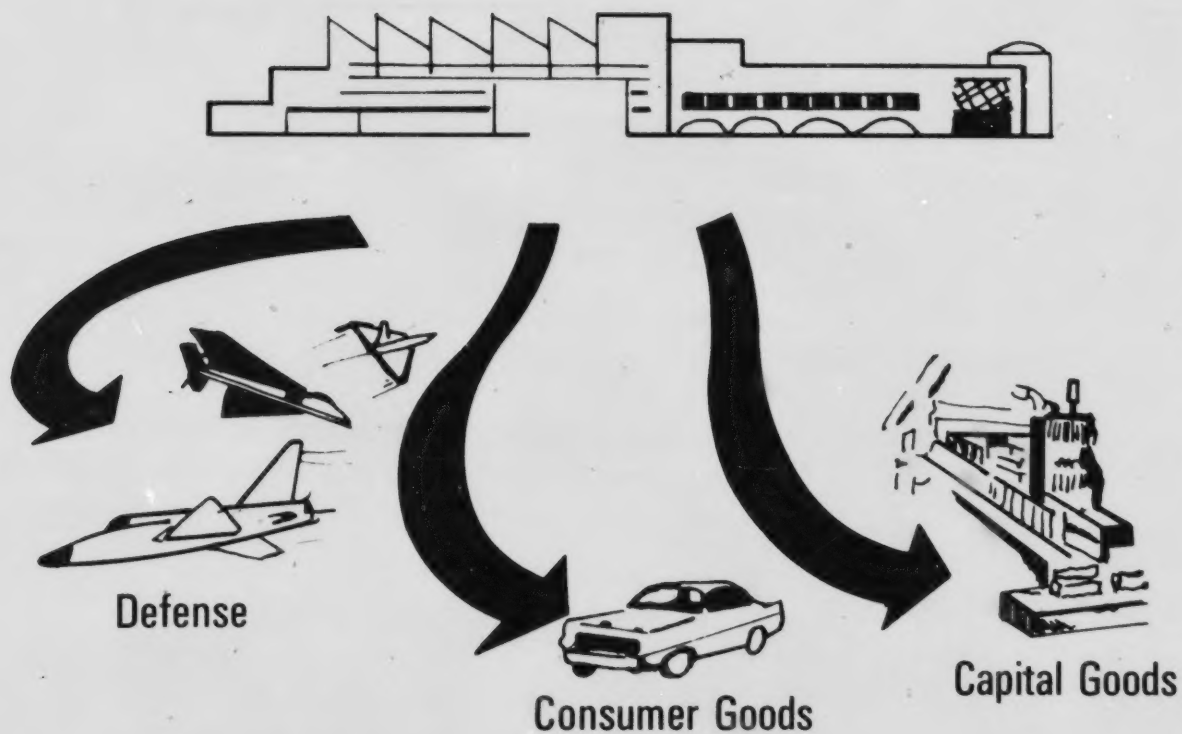
(Continued)

	USA	USSR
Population (1969)	203,213,000	240,567,000
Gross National Product-- Value of total goods and services produced per person (1970)	\$4,757	\$2,000
Telephones in use	115,222,000	12,000,000
Mail sent	79,968,000,000	7,584,000,000
Daily newspaper circulation	62,060,000	26,911,000
Radios	285,000,000	90,100,000
Televisions	81,000,000	30,744,000

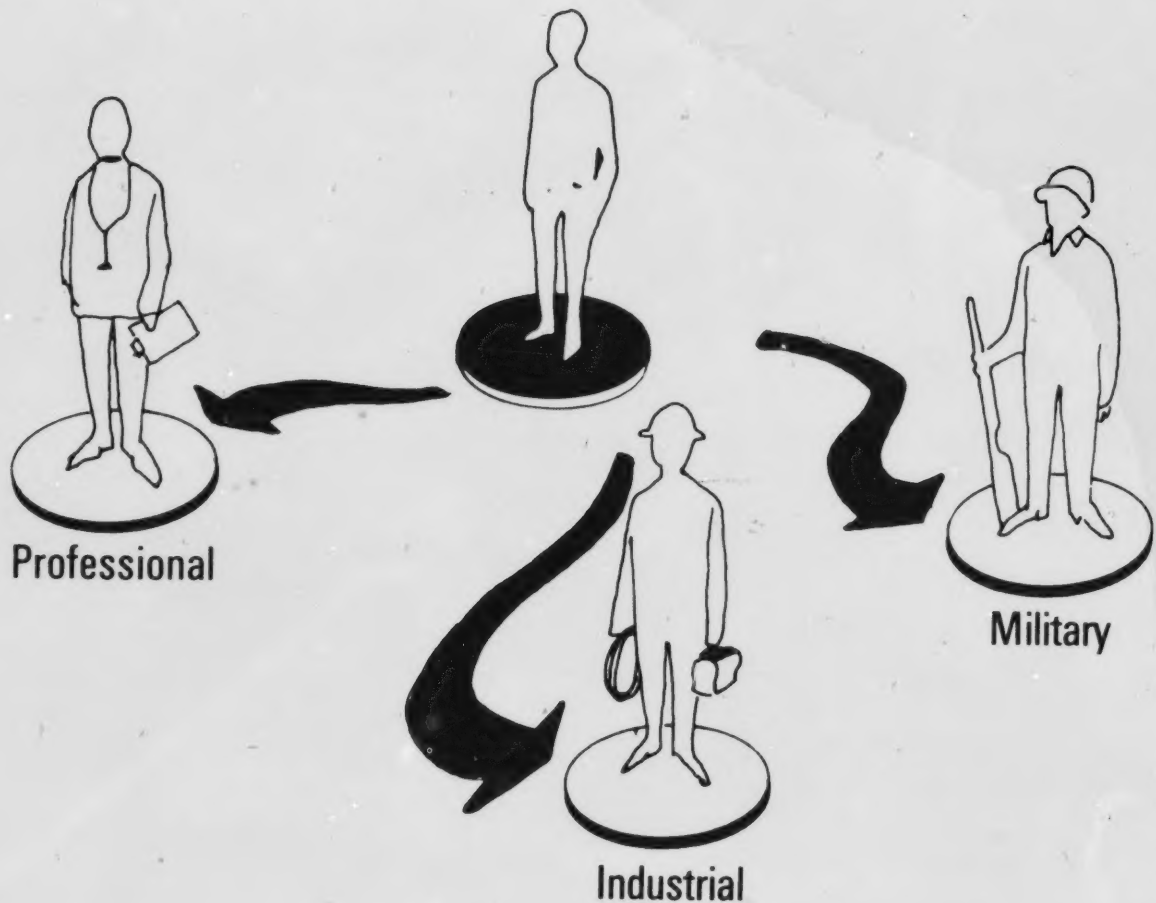
Alternate Uses for Scarce Land



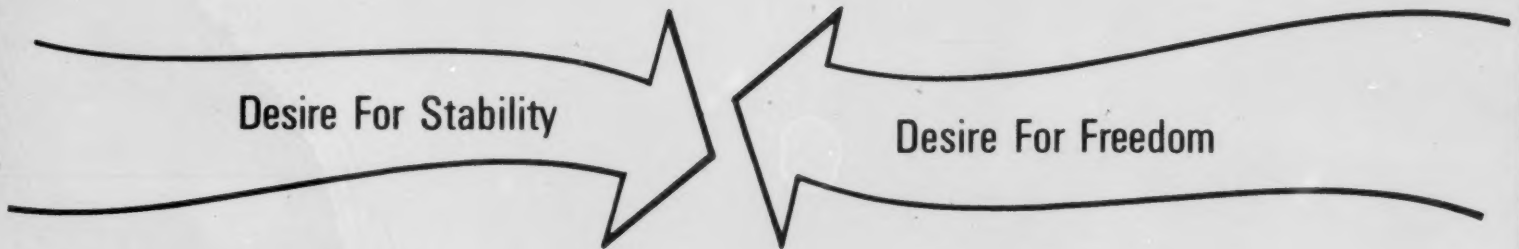
Alternate Uses for Scarce Capital



Alternate Uses for Scarce Manpower



Desire for Stability vs Desire for Freedom



Wage and price controls
to prevent
inflation

may conflict with

Free decision-making
in the market by worker,
businessperson, and
consumer

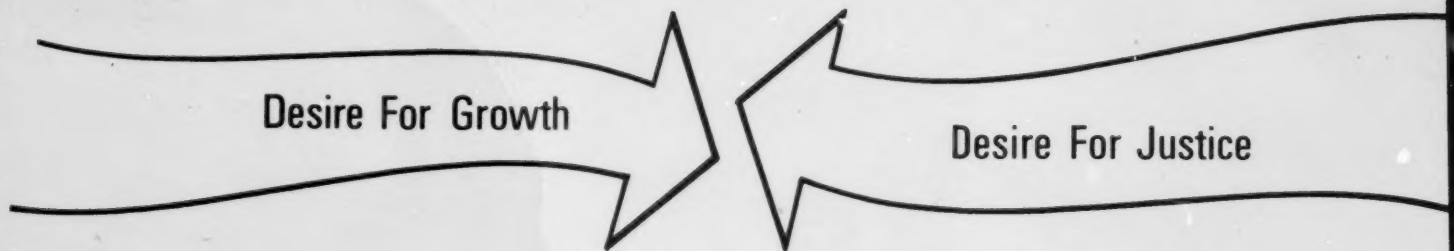
Desire for Security vs Desire for Efficiency



A tariff on foreign goods
entering the U.S. to
protect domestic
producers

may conflict with . . . free trade which
leads to more effective
use of productive
resources and gives
consumers lower prices

Desire for Growth vs Desire for Justice

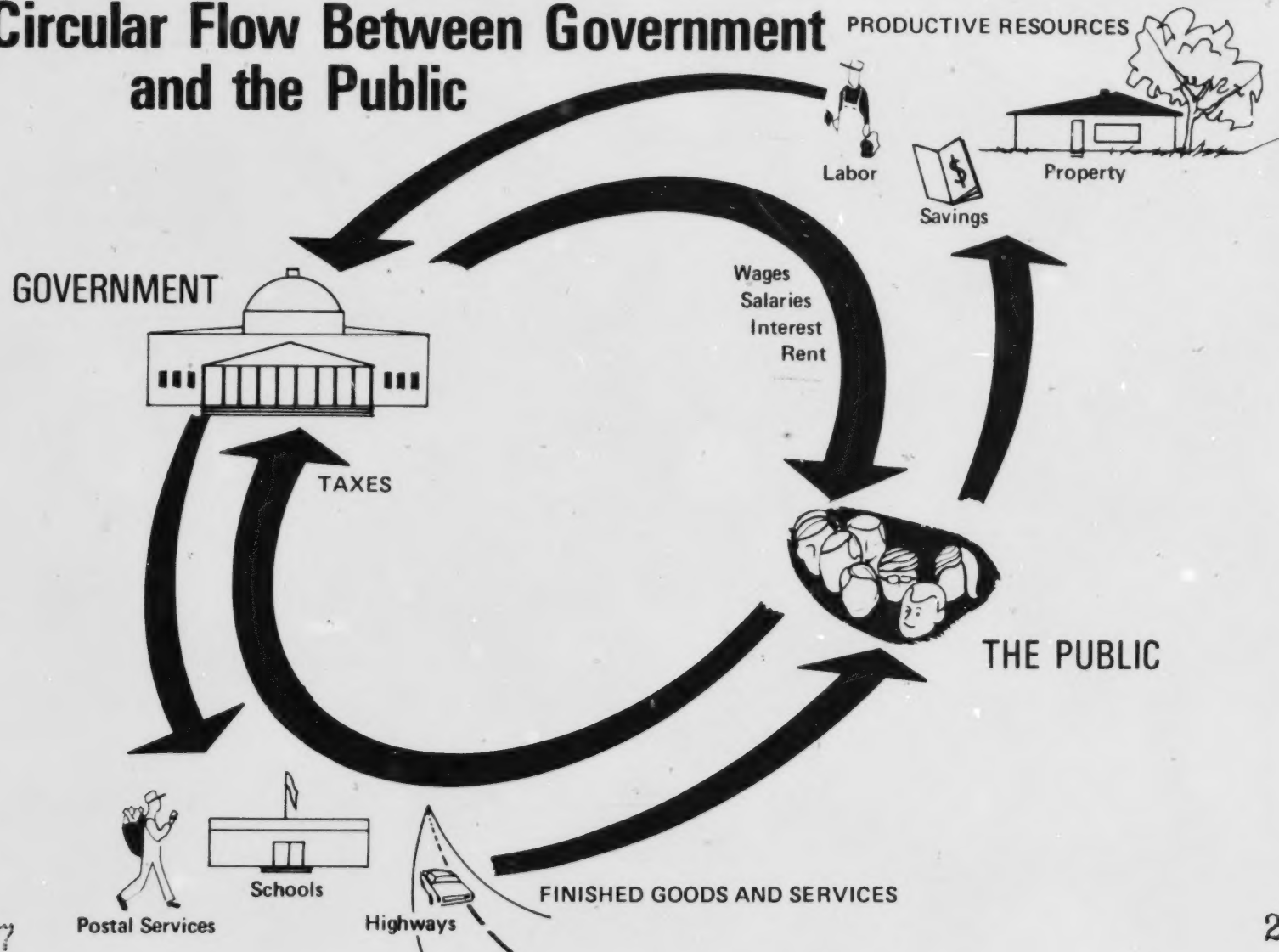


Building interstate
highways around
cities to improve
transportation . . .

may conflict with . . .

Business interests
of motels, gas stations,
and restaurants on old
road through city

Circular Flow Between Government and the Public



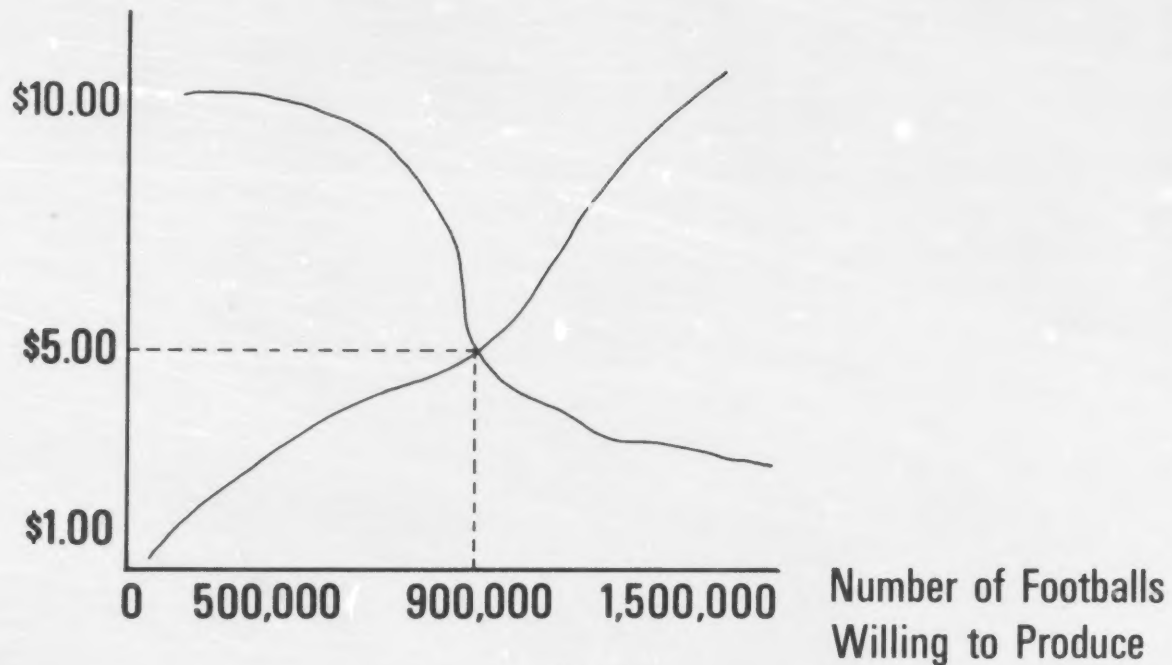
Supply and Demand Schedule

Price of Phonograph Album	Number of Phonograph Albums Wanted at that Price	Number of Phonograph Albums Supplied at that Price
\$5.00	500,000	1,000,000
\$4.00	600,000	900,000
\$3.50	700,000	700,000
\$3.00	800,000	600,000
\$2.00	1,000,000	400,000

Supply and demand determines price and number produced

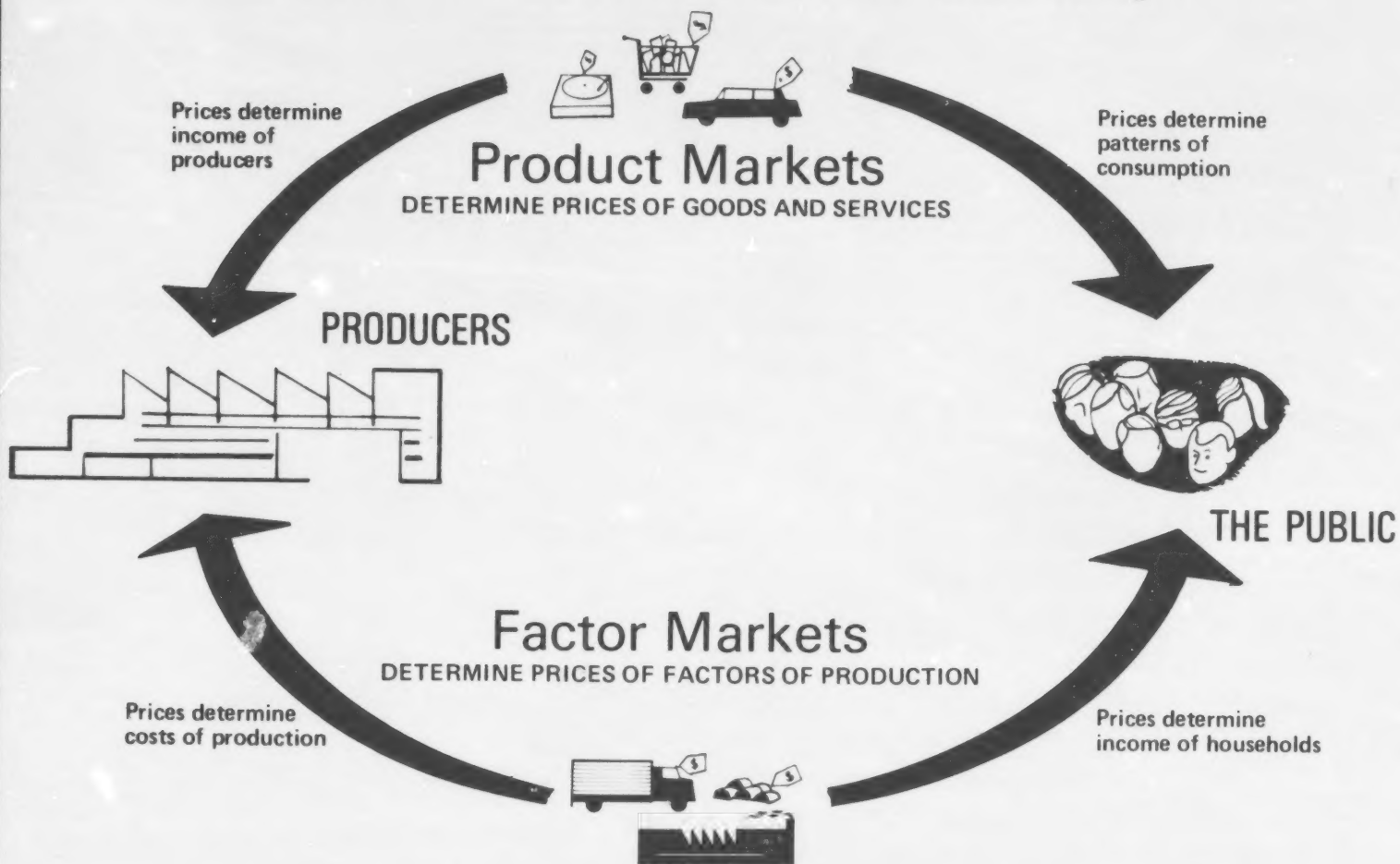
Supply and Demand Curves

Price of Footballs

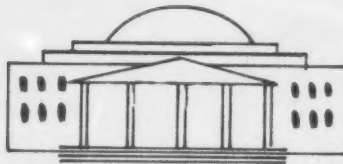


At this point in time, 900,000 footballs would be produced at a price of \$5.00 each

Ways Prices Influence the Economy

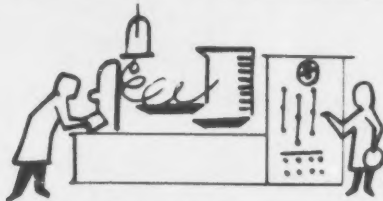


Helping Growth



Stable Government

Encourages business, incentives for citizens



Research and Development

Quantities of new improved products at less cost



Modern Tools

Rising productivity, less drain on human energy



Mass Production

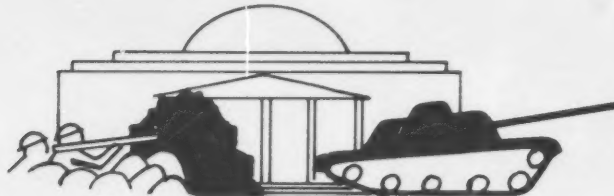
Abundant supply of low-priced goods



Mass Education

Increased supply of skilled labor

Limiting Growth



Unstable Government

Discourages business, uncertainties for citizens



Limited Technology

Limited products and higher prices



Primitive Tools

Low productivity, heavy drain on human energy



Production By Hand

Small supply of high-priced goods



Lack of Education

Shortage of labor skills

FREE ENTERPRISE SYSTEM UNIT II

TEST

1. Match the terms on the right to the correct definitions.

- | | |
|---|-----------------------|
| _____ a. Amount of a good or service that will be offered for sale at a given price and time | 1. Economics |
| _____ b. Amount of a good or service wanted at a given price and time | 2. Free enterprise |
| _____ c. System where the factors of production (labor, management, property, and savings) flow from the public to the producers and where money payments (wages, salaries, interest, rent, and dividends) flow from the producers back to the public | 3. Demand |
| _____ d. System where goods and services are sold by producers to consumers who in turn pay money to the producers for these goods and services | 4. Supply |
| _____ e. Property owned by or due a business | 5. Elasticity |
| _____ f. Economic and political system where the government controls <u>most</u> means of production | 6. Inelasticity |
| _____ g. Accumulated goods designed to bring in income | 7. Product market |
| _____ h. Services performed by people with skills for wages | 8. Factor market |
| _____ i. Person who organizes and manages a business, assuming the risk for the sake of profit | 9. Communism |
| _____ j. Ability to produce more goods and services with fewer resources | 10. Capitalism |
| _____ k. System where most production is done by privately owned corporations, partnerships, and private citizens in a free market | 11. Socialism |
| | 12. Assets |
| | 13. Liabilities |
| | 14. Natural resources |
| | 15. Labor |
| | 16. Capital |
| | 17. Management |
| | 18. Technology |
| | 19. Entrepreneur |

- _____ l. Study of how persons can best consume, produce, and distribute goods and services to try to satisfy their never-ending and ever-increasing wants
 - _____ m. Condition where demand is not affected much by a change in price
 - _____ n. How much the demand for a good or service will increase if the price is lowered or how much the demand will decrease if the price is raised
 - _____ o. Economic and political system characterized by elected representatives, limited government control, and freedoms such as freedom of speech, the right to own property, the right to choose a job, and freedom of religion
 - _____ p. Economic and political system where the government leaders try to achieve equality by controlling all property and production and by deciding how and to whom goods and services are distributed
 - _____ q. Materials supplied by nature
 - _____ r. All claims against a corporation or entity
 - _____ s. Skill to direct and control other resources
2. List four resources necessary for production of goods and services.
- a.
 - b.
 - c.
 - d.

3. Match the economic goals on the right to the correct descriptions.

_____ a. Protecting against risks people run into in their daily lives	1. Economic efficiency
_____ b. Getting the most of time, energy, money, and abilities	2. Economic growth
_____ c. Applying economic policies to the ideas about what is right and wrong	3. Economic security
_____ d. Obtaining better education, highways, hospitals, postal service, fire and police protection, and recreational facilities for all Americans	4. Economic freedom
_____ e. Avoiding recessions, depressions, and inflation	5. Economic justice
_____ f. Going into business to produce whatever goods and services a person thinks he/she can sell at a profit	6. Economic stability

4. List the three roles of the government in the economy.

a.

b.

c.

5. Discuss in a short paragraph the roles of individuals and businesses in the economy.

6. Describe the function of supply and demand schedules.
7. List three factors that determine the degree of elasticity of demand.
- a.
 - b.
 - c.
8. Select from the list below ways prices influence the economy by placing an "X" in the correct blanks.
- ☐ a. Prices determine what will be produced by showing what is profitable and not profitable to sell
 - ☐ b. Prices determine how scarce resources will be used
 - ☐ c. Prices determine who can afford certain goods and services
 - ☐ d. Individual decisions are influenced by prices
 - ☐ e. People collectively determine prices by what they are willing to buy
 - ☐ f. Producers try to learn how consumers will "vote" or purchase goods and services by studying past sales records and by conducting marketing studies
9. List four benefits of competition and profit.
- a.
 - b.
 - c.
 - d.

13. Discuss problems with government involvement in the economy.

14. Select from the list below reasons for striving to reach economic goals by placing an "X" in the correct blanks.

- ☐ a. Raise the standard of living for the upper classes
- ☐ b. Have full employment
- ☐ c. Compete in the international market with countries such as Japan and Germany
- ☐ d. Meet the challenge of Communism to replace the United States as the world's leading power
- ☐ e. Provide assistance and guidance to developing countries
- ☐ f. Raise standard of living for lower classes of employees

FREE ENTERPRISE SYSTEM
UNIT II

ANSWERS TO TEST

1. a. 4 h. 15 o. 10
 b. 3 i. 19 p. 9
 c. 8 j. 18 q. 14
 d. 7 k. 2 r. 13
 e. 12 l. 1 s. 17
 f. 11 m. 6
 g. 16 n. 5
2. a. Capital
 b. Management
 c. Labor
 d. Natural resources
3. a. 3 d. 2
 b. 1 e. 6
 c. 5 f. 4
4. a. Producer and consumer
 b. Regulator and protector
 c. Promoter of economic goals of American people
5. Discussion should include:
 - a. Individuals and businesses save money
 - b. Savings are then invested in machines, tools, factories, stores, and offices
 - c. Labor works to produce goods and services for itself and others
 - d. Businesses provide wages, salaries, and stock dividends with which individuals can save and/or purchase goods and services

6. To determine price and quantity of good or service
7.
 - a. Whether a good or service is a necessity or luxury
 - b. Availability and price of substitute products
 - c. Amount of money people are willing and able to spend
8. a, b, c, d, e, f
9. Any four of the following:
 - a. Stimulates the development of new or improved goods and services
 - b. Causes scarce resources to be used as efficiently as possible
 - c. Reduces prices
 - d. Motivates people to open new businesses
 - e. Creates new jobs
 - f. Encourages more effective selling and promotion techniques
10. Discussion should include:
 - a. Permits local, state, and federal governments to play a role in how resources will be used
 - b. Allows some monopolies to exist
 - c. Has profit motive as main incentive
 - d. Maintains efficiency through competition in the marketplace
 - e. Determines kinds and levels of production mainly by consumer purchases
 - f. Provides rights to own property, to enter or leave a job, and to make contracts
11. Description should include:
 - a. Floor (minimum) and ceiling (maximum) boundaries set on wages and prices
 - b. Regulations on public utilities
 - c. Tariffs on imports to encourage the sale of American goods

12. Any three of the following:
- a. Larger populations and movement to large cities require more goods and services
 - b. Need for national defense has increased
 - c. Desire for justice
 - d. Desire for economic security
13. Discussion should include:
- a. Government is not as efficient as private business
 - 1) Government agencies do not have to use resources wisely in order to make a profit or to compete
 - 2) Civil service safeguards lessen the influence of politics on government employees but may make it difficult to fire the few people who may not do a job well
 - b. People often lose certain freedoms of choice
14. b, c, d, e

BECOMING A GOOD LEADER
UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list characteristics of a good leader, discuss the importance of being a good leader, and name steps to take in order to become a good leader. The student should complete a personality self-rating scale to determine how he/she rates as a leader. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Define *leadership*.
2. List characteristics of a good leader.
3. Discuss in a short paragraph the importance of being a good leader.
4. Name steps one should follow in becoming a good leader.
5. Name values of having leadership ability.
6. Rate himself/herself as a leader after completing the personality self-rating scale.
7. Select leaders within the community, listing traits that make them good leaders.

BECOMING A GOOD LEADER
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Discuss terminal and specific objectives.
- D. Discuss information and assignment sheets.
- E. Help evaluate the student according to the personality self-rating scale.
- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Complete assignment sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Assignment sheets
 - 1. Assignment Sheet #1--Personality Self-Rating Scale
 - 2. Assignment Sheet #2--Selecting Leaders Within The Community
- D. Test
- E. Answers to test

II. References:

- A. *Official Manual*. Alexandria, Virginia: Future Farmers of America, 1975.
- B. Gray, Jarrell D., and Jackson, J. R. *Leadership Training and Parliamentary Procedure for FFA*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1958.
- C. *Animal Science*. Columbia, Missouri: State Department of Education, Agricultural Education Section, University of Missouri.

BECOMING A GOOD LEADER
UNIT III

INFORMATION SHEET

- I. Leadership--Combination of qualities which inspires confidence, draws others toward the leader, and causes them to follow
- II. Characteristics of a good leader
 - A. Preparedness
(NOTE: Leadership takes work as well as practice.)
 - B. Group-mindedness
(NOTE: Regard yourself as a part of the group. Say "we" instead of "I."
Do not try to run the crowd; instead, be guided by the crowd's wishes.)
 - C. Consideration for others
(NOTE: Be understanding and friendly.)
 - D. Poise
(NOTE: Do not let irritations bother you.)
 - E. Humility
(NOTE: Be confident, but not cocky. Do not be afraid to reveal you do not know everything.)
 - F. Hard work
(NOTE: Do not ask anyone to do something that you would not be willing to do yourself.)
 - G. Responsibility
(NOTE: Live up to your work and duties.)
 - H. Cooperativeness
(NOTE: Know how to work with others and enjoy working with them.)
 - I. Happiness
(NOTE: Enjoy life - the simple things as well as the big.)

INFORMATION SHEET

J. Imagination

(NOTE: Help the persons in your group learn and grow through the activities.)

K. Preciseness

(NOTE: Be able to express yourself effectively.)

L. Pride

(NOTE: Take pride in what you do. Take pride in being a leader, but earn it.)

M. Neatness

(NOTE: Always be neat in dress and personal appearance.)

N. Courtesy

(NOTE: The words *please* and *thank you* pay dividends; use them often.)

O. Understanding

(NOTE: Know members' opinions and be ready to meet changing situations.)

P. Ambition

(NOTE: Set goals and make them high, but be sure to reach them.)

Q. Open-mindedness

(NOTE: Take advice, but do your own thinking.)

R. Curiosity

(NOTE: Analyze all the facts before you draw conclusions.)

S. Energy

(NOTE: Do your best at all times. Plan to make the most effective use of your time.)

INFORMATION SHEET

III. Importance of being a good leader

- A. Self-satisfaction
- B. Leadership needed in all fields
- C. Challenge to learn leadership
- D. Respect created for others
- E. Maturation of individual

(NOTE: Other factors may be added by instructor.)

IV. Steps in becoming a good leader

(NOTE: Leaders are made, not born.)

- A. Study qualities of a good leader
- B. Evaluate own weak and strong points
- C. Become a good follower
- D. Develop a plan for training oneself as a leader

V. Values of having leadership ability

- A. Education
- B. Respect
- C. Advancement in an occupation
- D. Financial betterment
- E. Pride
- F. Security

BECOMING A GOOD LEADER UNIT III

ASSIGNMENT SHEET #1--PERSONALITY SELF-RATING SCALE

Circle the appropriate number following each trait. Four is outstanding, three is above average, two is average, one is poor. Total your score on the following page.

- | | | | | | |
|-----|--|---|---|---|---|
| 1. | Do I maintain a well-groomed appearance? | 1 | 2 | 3 | 4 |
| 2. | Do I have a pleasing voice? | 1 | 2 | 3 | 4 |
| 3. | Is my posture alert and poised? | 1 | 2 | 3 | 4 |
| 4. | Is my disposition cheerful? | 1 | 2 | 3 | 4 |
| 5. | Do I make friends easily? | 1 | 2 | 3 | 4 |
| 6. | Do I exert a positive leadership? | 1 | 2 | 3 | 4 |
| 7. | Am I generally thoughtful of the feelings of others? | 1 | 2 | 3 | 4 |
| 8. | Is my enthusiasm sincere and contagious? | 1 | 2 | 3 | 4 |
| 9. | Do I persevere until I achieve success? | 1 | 2 | 3 | 4 |
| 10. | Am I sincere in my interest in other people? | 1 | 2 | 3 | 4 |
| 11. | Am I ambitious to get ahead? | 1 | 2 | 3 | 4 |
| 12. | Do I get along well with others? | 1 | 2 | 3 | 4 |
| 13. | Do I react constructively to criticism? | 1 | 2 | 3 | 4 |
| 14. | Do I remember names and faces? | 1 | 2 | 3 | 4 |
| 15. | Am I punctual on all occasions? | 1 | 2 | 3 | 4 |
| 16. | Do I have and show a spirit of cooperation? | 1 | 2 | 3 | 4 |
| 17. | Am I free from prejudice? | 1 | 2 | 3 | 4 |
| 18. | Do I know how people react in most situations? | 1 | 2 | 3 | 4 |
| 19. | Am I generally a good listener? | 1 | 2 | 3 | 4 |
| 20. | Do I refuse to allow what other people say hurt me? | 1 | 2 | 3 | 4 |

ASSIGNMENT SHEET #1

- | | | | | | |
|-----|--|---|---|---|---|
| 21. | Can I criticize without being offensive? | 1 | 2 | 3 | 4 |
| 22. | Do I usually like people for what they are, or do I wait to see if they like me? | 1 | 2 | 3 | 4 |
| 23. | Do I enjoy being part of a group? | 1 | 2 | 3 | 4 |
| 24. | Am I reliable? | 1 | 2 | 3 | 4 |
| 25. | Can I adapt myself to all situations? | 1 | 2 | 3 | 4 |
| 26. | Am I easily discouraged? | 1 | 2 | 3 | 4 |
| 27. | Do I apply myself to the problems of each day? | 1 | 2 | 3 | 4 |
| 28. | Can I make a decision quickly and accurately? | 1 | 2 | 3 | 4 |
| 29. | Am I loyal to my superiors and associates? | 1 | 2 | 3 | 4 |
| 30. | Do I try to get the other fellow's point of view? | 1 | 2 | 3 | 4 |
| 31. | Am I neat and clean in my work as well as in my personal appearance? | 1 | 2 | 3 | 4 |
| 32. | Do I know where I make my mistakes, and do I admit them? | 1 | 2 | 3 | 4 |
| 33. | Am I looking for opportunities to serve others better? | 1 | 2 | 3 | 4 |
| 34. | Am I following a systematic plan for improvement and advancement? | 1 | 2 | 3 | 4 |
| 35. | Can I accept honors and advancements and yet keep my feet on the ground? | 1 | 2 | 3 | 4 |
| 36. | Am I playing the game of life honestly and fairly with myself, my fellow members, and others with whom I work? | 1 | 2 | 3 | 4 |

TOTAL SCORE _____

Evaluation of Assignment Sheet #1

Evaluate your scores--If your score totaled over 100, your personality rating is definitely superior. If you have been honest with yourself, you are among the people who are most likely to succeed. A score of 90 - 100 is above average; 75 - 90 is average; below 75 shows plenty of room for improvement. How did you rate?

BECOMING A GOOD LEADER
UNIT III

ASSIGNMENT SHEET #2--SELECTING LEADERS WITHIN THE COMMUNITY

Select three individuals in your local community which appear to you as good leaders.
List three leadership traits for each individual.

NAME	LEADERSHIP TRAITS
1. _____	a. _____ b. _____ c. _____
2. _____	a. _____ b. _____ c. _____
3. _____	a. _____ b. _____ c. _____

BECOMING A GOOD LEADER
UNIT III

TEST

1. Define *leadership*.
2. List five characteristics of a good leader.
 - a.
 - b.
 - c.
 - d.
 - e.
3. Discuss in a short paragraph the importance of being a good leader.
4. Name four steps to follow in becoming a good leader.
 - a.
 - b.
 - c.
 - d.
 - i. Name five values of having leadership ability.
 - a.
 - b.
 - c.
 - d.
 - e.

6. Rate yourself as a leader after completing the personality self-rating scale.
7. Select leaders within the community, listing traits that make them good leaders.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

BECOMING A GOOD LEADER
UNIT III

ANSWERS TO TEST

1. Leadership--Combination of qualities which inspires confidence, draws others toward the leader, and causes them to follow
2. Any five of the following:
 - a. Preparedness
 - b. Group-mindedness
 - c. Consideration for others
 - d. Poise
 - e. Humility
 - f. Hard work
 - g. Responsibility
 - h. Cooperativeness
 - i. Happiness
 - j. Imagination
 - k. Preciseness
 - l. Pride
 - m. Neatness
 - n. Courtesy
 - o. Understanding
 - p. Ambition
 - q. Open-mindedness
 - r. Curiosity
 - s. Energy

3. Discussion should include:
 - a. Self-satisfaction
 - b. Leadership needed in all fields
 - c. Challenge to learn leadership
 - d. Respect created for others
 - e. Maturation of individual
 - f. Other factors that instructor felt were necessary
4.
 - a. Study qualities of a good leader
 - b. Evaluate own weak and strong points
 - c. Become a good follower
 - d. Develop a plan for training oneself as a leader
5. Any five of the following:
 - a. Education
 - b. Respect
 - c. Advancement in an occupation
 - d. Financial betterment
 - e. Pride
 - f. Security
6. Evaluated to the satisfaction of the instructor
7. Evaluated to the satisfaction of the instructor

Section E Human Relations and Leadership

Student's Name

[illegible]

BASIC TRADE ARITHMETIC UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to match terms and definitions associated with basic trade arithmetic, calculate problems dealing with area, and solve basic ratio and proportion problems. The student should also be able to do basic estimating. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with basic trade arithmetic to the correct definitions.
2. Calculate basic problems dealing with area.
3. Calculate basic problems dealing with estimating.
4. State the difference between ratio and proportion.
5. Solve basic arithmetic problems.
6. Estimate materials needed for a specific job.
7. Solve basic ratio and proportion problems.

BASIC TRADE ARITHMETIC
UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information and assignment sheets.

(NOTE: Instructor may want to provide real situations for problems in estimating. Instructor may also want to add problems for student practice.)

- F. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Complete assignment sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Area
 - 2. TM 2--Ratio and Proportion

D. Assignment sheets

1. Assignment Sheet #1--Solve Basic Arithmetic Problems
2. Assignment Sheet #2--Estimate Materials Needed for a Specific Job
3. Assignment Sheet #3--Solve Basic Ratio and Proportion Problems

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

- A. Spann, Margaret. *Vocational Related Math*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1972.
- B. Curtes, Ed. *Forestry*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1974.

BASIC TRADE ARITHMETIC
UNIT I

INFORMATION SHEET

I. Terms and definitions

A. Arithmetic--Branch of mathematics that deals with real numbers and their computations

B. Ratio--Comparison of true quantities by division

Example: 1 part cement to 1 part lime to 3 parts sand = 1:1:3

C. Proportion--Statement that one ratio is equivalent to another

Example: 1:1:3 = .5:.5:1.5

D. Linear--Relating to, consisting of, or resembling a straight line

E. Modular--Nominal units based on a 4" module

F. Estimating--Procedure in determining amounts of materials needed to complete a specific job

G. Area--Total outside surface expressed in square units

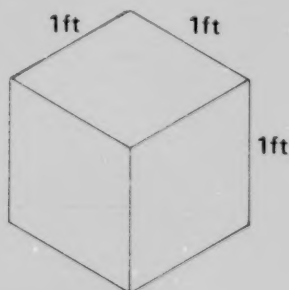
Examples: Square inches, square feet

H. Formula--Conventional method of solving an arithmetic problem

I. Volume--Measure of amount a container will hold

J. Cubic unit--Unit that has three dimensions including length, width, and height

K. Cubic foot--Object that is 1 ft long, 1 ft wide, and 1 ft high



L. Nominal size--Size of brick and mortar joint

INFORMATION SHEET

II. Calculate problems dealing with area (Transparency 1)

A. Formula--Length x width = area

B. Problem

1. Find area of an object 8" wide and 10" long

Example: $8" \times 10" = 80$ square inches

2. Find area of a wall 12' high and 20' long

Example: $12' \times 20' = 240$ square feet

3. Find area of a wall 15' 3" high and 21' 9" long

Example: $15' 3" = 15.25'$

$21' 9" = 21.75'$

$15.25' \times 21.75' = 331.6875$ or 331.7 sq ft

III. Estimating

A. Using arithmetic for estimating masonry units

1. Find area of wall to be constructed
2. Subtract total area of openings
3. Find area of masonry unit to be used
4. Divide area of masonry unit into total square feet in wall

(NOTE: This will give the approximate number of masonry units needed. Generally 5% is added to total for breakage and waste.)

Example: Find number of brick 2" x 4" x 12" (nominal size includes mortar joint) needed in a wall 10' high and 20' long with a window opening 30" x 48"

$$20' \times 10' = 200 \text{ sq ft}$$

$$30" \times 48" = 1440 \text{ sq in}$$

$$1440 \text{ sq in} \div 144 \text{ sq in} = 10 \text{ sq ft}$$

$$200 \text{ sq ft} - 10 \text{ sq ft} = 190 \text{ sq ft in wall to be covered by brick}$$

$$2" \times 12" = 24 \text{ sq in per brick}$$

$$144 \div 24 \text{ sq in} = 6 \text{ brick per sq ft}$$

$$190 \text{ sq ft} \times 6 \text{ brick per sq ft} = 1140 \text{ brick needed}$$

$$1140 \times 5\% = 57.00$$

$$1140 + 57 = 1197 \text{ brick for wall}$$

INFORMATION SHEET

B. Using a table for estimating masonry units

1. Tables

FOUR- AND SIX-INCH BRICK FACING WALLS IN RUNNING BOND
(Full Bed and Head Joints)

Table I - Modular

Nominal Size of Brick (Inches)	Number of Brick per Sq Ft of Wall	Cu Ft of Mortar* per Sq Ft of Wall		Cu Ft of Mortar* per 1000 Brick	
		3/8" joint	1/2" joint	3/8" joint	1/2" joint
4 X 2 2/3 X 8	6.75	0.0608	0.0765	8.90	11.30
4 X 2 X 12	6.00	0.0676	0.09	11.30	15.00
4 X 2 2/3 X 12	4.50	0.0535	0.071	11.90	15.80
4 X 3 1/5 X 8	5.625	0.0517	0.067	9.36	11.92
4 X 4 X 8	4.50	0.0432	0.0575	9.60	12.80
4 X 4 X 12	3.00	0.039	0.052	13.00	17.20
"SCR brick" **	4.50	--	0.155	--	34.25

(*) 10 percent added for waste

(**) Designed for 1/2" joint only

EIGHT- AND TWELVE-INCH BRICK BACKUP WALLS IN RUNNING BOND
(Full Bed, Head, and Collar Joints)

Table II - Modular

Nominal Size of Brick (inches)	8" Wall			12" Wall		
	Number of Brick	Cu Ft of Mortar*		Number of Brick	Cu Ft of Mortar*	
		3/8" joint	1/2" joint		3/8" joint	1/2" joint
2 2/3 x 4 x 8	13.50	0.1544	0.1988	20.25	0.2489	0.3211
4 x 4 x 8	9.00	0.1210	0.1610	13.50	0.1984	0.2641

(*) 10 percent added for waste

2. Problem--How many cubic feet of mortar are needed for 566sq ft of 4" thick wall using standard brick (4" x 2 2/3" x 8") with 3/8" joint

Example: $566 \times 0.0608 = 34.4128$ or 34.41 cu ft

INFORMATION SHEET

C. Amounts of cement, lime, and sand needed per cubic foot of mortar

1. Table

QUANTITIES OF CEMENT, LIME, AND SAND REQUIRED
PER CUBIC FOOT OF MORTAR (By Volume)

Table IX

Mortar Type	Portland Cement Cu Ft	Hydrated Lime Cu Ft	Sand Cu Ft
M (A-1)	0.3	0.075	0.925
S (A-2)	0.22	0.11	0.990
N (B)	0.163	0.163	0.978
O (C)	0.11	0.22	0.990
K (D)	0.065	0.26	0.975

2. Problem--How much cement, lime, and sand are needed for the 34.41 cu ft of type M mortar?

a. $0.3 \times 34.41 \text{ cu ft} = 10.32 \text{ cu ft cement}$

b. $0.075 \times 34.41 \text{ cu ft} = 2.58 \text{ cu ft lime}$

c. $0.925 \times 34.41 \text{ cu ft} = 31.83 \text{ cu ft sand}$

(NOTE: Instructor may want to add problems and examples of methods and devices used to estimate materials.)

IV. Ratio and proportion (Transparency 2)

A. Ratio indicates parts of material per mix

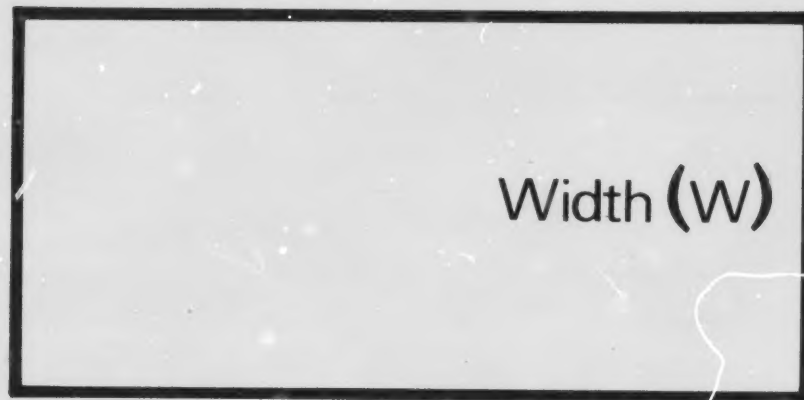
Example: 1:1:3 ratio means 1 part portland cement, 1 part hydrated lime, and 3 parts sand in a mixture of mortar

B. Proportion indicates the ratio is the same but quantity may be different

Example: $1:1:3 = .5:.5:1.5$ of same mix but in different volumes

Area

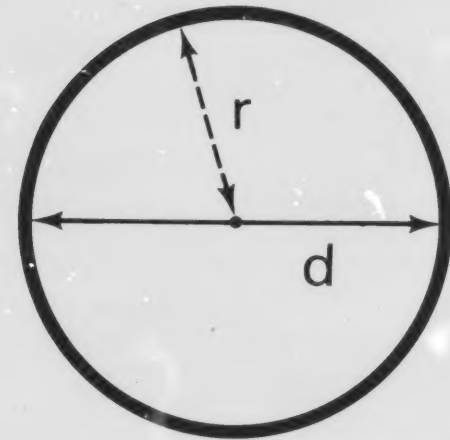
SQUARE or RECTANGLE



Length (L)

Length X Width = Area

CIRCLE



$$\pi = 3.1416$$

$$r = \frac{\text{diameter}}{2}$$

$$\pi r^2 = \text{area of circle}$$

Ratio and Proportion

$1:1:3 =$ ratio of cement,
lime, and sand
in mortar mixed

$.5:.5:1.5 =$ proportion of ratio
 $1:1:3$
cut in half

BASIC TRADE ARITHMETIC UNIT I

ASSIGNMENT SHEET #1--SOLVE BASIC ARITHMETIC PROBLEMS

Solve the following problems. Show all your work.

1. Addition

$$\begin{array}{r} \text{a.} \quad 25 \\ 50 \\ \hline 72 \end{array}$$

$$\begin{array}{r} \text{b.} \quad 16 \\ 5 \\ \hline 22 \end{array}$$

$$\begin{array}{r} \text{c.} \quad 142 \\ 271 \\ \hline 398 \end{array}$$

$$\begin{array}{r} \text{d.} \quad 5280 \\ 6751 \\ \hline 9438 \end{array}$$

$$\begin{array}{r} \text{e.} \quad 4 \frac{5}{8} \\ 6 \frac{3}{8} \\ \hline 7 \frac{1}{2} \end{array}$$

2. Subtraction

$$\begin{array}{r} \text{a.} \quad 125 \\ 71 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b.} \quad 491 \\ 326 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c.} \quad 5426 \\ 4739 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d.} \quad 566 \\ 74 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e.} \quad 5 \frac{2}{3} \\ 2 \frac{1}{4} \\ \hline \end{array}$$

3. Multiplication

$$\begin{array}{r} \text{a.} \quad 22 \\ 14 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b.} \quad 45 \\ 15 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c.} \quad 462 \\ 75 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d.} \quad 596 \\ 371 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e.} \quad 5698 \\ 473 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f.} \quad 12 \\ 2 \frac{3}{4} \\ \hline \end{array}$$

4. Division

$$\text{a.} \quad 7 \overline{) 21}$$

$$\text{b.} \quad 12 \overline{) 144}$$

$$\text{c.} \quad 90 \overline{) 360}$$

$$\text{d.} \quad 542 \overline{) 7588}$$

$$\text{e.} \quad 27 \overline{) 722}$$

$$\text{f.} \quad 5 \frac{1}{2} \overline{) 55}$$

ASSIGNMENT SHEET #1

5. Story problems

- a. Find area of a wall that is 72 feet long and 14 feet high.
- b. A wall has 592 square feet of surface with 71 square feet of openings. What is the total square feet of area that will be covered by brick?
- c. The face of a brick measures 2" x 12". How many brick are needed for 1 square foot?
- d. A cubic foot of cement weighs 94 lb. A mortar mix calls for .75 cubic feet. How many pounds of cement are needed for the mix?
- e. You are asked to build a rowlock sill on a window with a masonry opening of 1' 8 7/8". Specifications call for you to use 2 1/4" brick. Allow 5/16" for joints. How many brick will be needed for the rowlock sill?
- f. How many courses at 2 2/3" (brick and joint) will be needed to reach a window sill height of 32".

BASIC TRADE ARITHMETIC
UNIT I

ASSIGNMENT SHEET #2-ESTIMATE MATERIALS NEEDED FOR A SPECIFIC JOB

Find number of brick needed for the four walls of the building.

Side one-12' x 24'

Side two-12' x 18'

Side three-12' x 24'

Side four-7' x 18'

Side one has one door 3' x 7' and 3 windows 30" x 48"

Side two has 4 windows 24" x 24"

Side three has two doors 3' x 7'

Side four has no openings

Estimate number of brick needed.

Add 5% for waste and breakage. Nominal brick size is $2\frac{2}{3}$ " x 4" x 8" and requires 6.75 brick per square feet of surface.

Show all work.

BASIC TRADE ARITHMETIC
UNIT I

ASSIGNMENT SHEET #3--SOLVE BASIC RATIO AND PROPORTION PROBLEMS

Solve the following problems. Show your work.

1. Convert this ratio to whole numbers.

.33:.33:1

2. What would be the proportions if the following mix were cut in half?

1:2:12

3. What would be the proportion if the following were tripled?

1:1:3

4. You are asked to mix a batch of mortar using 1:1:6 ratio but you will need six times this amount. What proportions of material will be needed?

5. A mixture of 1 part cement, 1 part lime, and 3 parts sand is needed to make 25 cubic feet of mortar. How many cubic feet of each are needed?

BASIC TRADE ARITHMETIC
UNIT I

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

- | | | | | |
|----|----|------------|----|-----------|
| 1. | a. | 147 | d. | 21,469 |
| | b. | 43 | e. | 18 1/2 |
| | c. | 811 | | |
| 2. | a. | 54 | d. | 492 |
| | b. | 165 | e. | 3 5/12 |
| | c. | 687 | | |
| 3. | a. | 308 | d. | 221,116 |
| | b. | 675 | e. | 2,695,154 |
| | c. | 34,650 | f. | 33 |
| 4. | a. | 3 | d. | 14 |
| | b. | 12 | e. | 26 R 20 |
| | c. | 4 | f. | 10 |
| 5. | a. | 1008 sq ft | d. | 70.5 |
| | b. | 521 sq ft | e. | 8 |
| | c. | 6 | f. | 12 |

Assignment Sheet #2--5733 brick needed

Assignment Sheet #3

1. 1:1:3
2. 5:1:6
3. 3:3:9
4. 6:6:36
5. 5 cu ft cement, 5 cu ft lime, and 15 cu ft sand

BASIC TRADE ARITHMETIC UNIT I

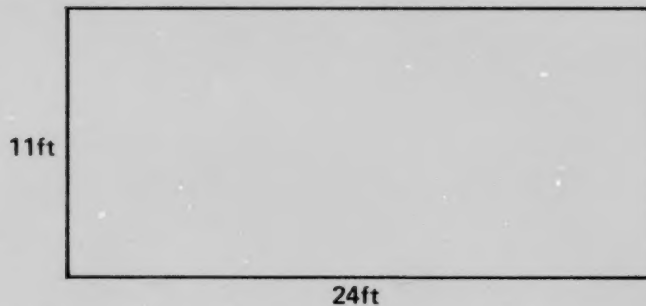
TEST

1. Match the terms on the right to the correct definitions.

- | | |
|--|------------------|
| _____ a. Nominal units based on a 4" module | 1. Cubic foot |
| _____ b. Statement that one ratio is equivalent to another | 2. Arithmetic |
| _____ c. Branch of mathematics that deals with real numbers and their computations | 3. Cubic unit |
| _____ d. Total outside surface expressed in square units | 4. Ratio |
| _____ e. Measure of amount a container will hold | 5. Volume |
| _____ f. Procedure in determining amounts of materials needed to complete a specific job | 6. Proportion |
| _____ g. Comparison of true quantities by division | 7. Formula |
| _____ h. Relating to, consisting of, or resembling a straight line | 8. Linear |
| _____ i. Unit that has three dimensions including length, width, and height | 9. Area |
| _____ j. Conventional method of solving an arithmetic problem | 10. Modular |
| _____ k. Object that is 1 ft long, 1 ft wide, and 1 ft high | 11. Estimating |
| _____ l. Size of brick and mortar joint | 12. Nominal size |

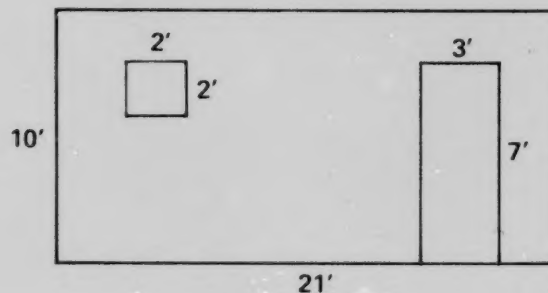
2. Calculate the following problem dealing with area using the formula given.

Length $\times$ width = area



3. Calculate the following problem dealing with estimating.

Six brick are required per square foot of wall space.



How many brick are required to cover the wall area less the openings?

4. State the difference between ratio and proportion.
5. Solve basic arithmetic problems.
6. Estimate materials needed for a specific job.
7. Solve basic ratio and proportion problems.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

BASIC TRADE ARITHMETIC
UNIT I

ANSWERS TO TEST

1. a. 10 g. 4
 b. 6 h. 8
 c. 2 i. 3
 d. 9 j. 7
 e. 5 k. 1
 f. 11 l. 12
2. 264 sq ft
3. 1110
4. a. Ratio indicates parts of material per mix
 b. Proportion indicates the ratio is the same but quantity may be different
5. Evaluated to the satisfaction of the instructor
6. Evaluated to the satisfaction of the instructor
7. Evaluated to the satisfaction of the instructor

BASIC BLUEPRINT READING UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to describe divisions found on building plans, identify types of lines found on a drawing, identify drawing symbols, and read measurements using an architect's scale. The student should be able to list major items found in a set of specifications and demonstrate the ability to read a blueprint, read a plan view, interpret detail and finish schedules, and interpret a set of brick masonry specifications. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with basic blueprint reading to the correct definitions.
2. Identify types of working drawings.
3. Describe divisions found in a set of building plans.
4. Identify types of lines that may be found on a drawing.
5. Identify drawing symbols.
6. Match commonly used abbreviations to the correct names.
7. Read measurements on a given architect's scale.
8. Select from a list items found on a structural drawing.
9. List major items that may be found in a set of masonry specifications.
10. Name items that may be shown in detail on a drawing.
11. Demonstrate the ability to:
 - a. Read the architect's scale.
 - b. Read a blueprint.
 - c. Interpret a set of brick masonry specifications.
 - d. Read a structural plan.
 - e. Read a plan view.
 - f. Interpret a finish schedule.

BASIC BLUEPRINT READING UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information and assignment sheets.
- F. Provide student with additional assignment sheets if necessary.

(NOTE: Instructor may want to get additional sets of plans and specifications on jobs in the community. Discuss details more in-depth.)

- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Complete activities outlined on assignment sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Elevation Section
 - 2. TM 2--Elevation Section (Continued)
 - 3. TM 3--Floor Plan

4. TM 4--Section View
5. TM 5--Construction or Scale Detail
6. TM 6--Site Plan
7. TM 7--Lines on a Drawing
8. TM 8--Drawing Symbols
9. TM 9--Architect's Scale
10. TM 10--Comparison of Solid Objects

D. Assignment sheets

1. Assignment Sheet #1--Read the Architect's Scale Using Full Scale (12" = 12")
2. Assignment Sheet #2--Read the Architect's Scale Using Half Scale (6" = 12")
3. Assignment Sheet #3--Read the Architect's Scale Using One-Fourth Scale (3" = 12")
4. Assignment Sheet #4--Read the Architect's Scale Using One-Eighth Scale (1 1/2" = 12")
5. Assignment Sheet #5--Read a Blueprint
6. Assignment Sheet #6--Interpret a Set of Brick Masonry Specifications
7. Assignment Sheet #7--Read a Structural Plan
8. Assignment Sheet #8--Read a Plan View
9. Assignment Sheet #9--Interpret a Finish Schedule

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

- A. Roark, William F. *Plan Reading for Brickmasons*. McLean, Virginia: Brick Institute of America, 1968.
- B. Hendrix, Laborn, and Patton, Bob. *Cement Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education, 1975.
- C. Roark, William F. *Technical Notes*. McLean, Virginia: Brick Institute of America, 1970.

BASIC BLUEPRINT READING
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Alphabet of lines--Set of conventional symbols covering all the lines needed to depict an object as to size and shape
- B. Architect's scale--Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot

Examples: $1/8$, $1/4$, $3/8$, $1/2$, $3/4$, $1\ 1/2$, and 3 inches to the foot
- C. Architectural drawing--Graphic representation shown with lines and symbols
- D. Shop drawing--Plans showing detailed information of specific items
- E. Blueprint--Copy of the original detailed drawing
- F. Detail--Drawing that gives complete detailed information for an element of construction
- G. Dimensions--Arrangement of lines and symbols to indicate the actual size for constructing the object that is represented
- H. Elevation--Drawing representing the front, sides, or rear face of a structure and usually made as though the observer were looking directly at it
- I. Plan view--In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans
- J. Scale drawing--Drawing made to a size either proportionally larger or smaller than the actual size of the object represented
- K. Section--Drawing of an object that has been cut to show internal construction
- L. Specifications--Detailed set of written instructions which explains the drawing, describes materials and equipment used in the structure as to quality and type, and becomes part of the contract
- M. Symbol--Arbitrary sign that has been standardized and is used to represent an object, quality, or method

INFORMATION SHEET

II. Types of working drawings

A. Elevation (Transparencies 1 and 2)

(NOTE: Characteristics include grade lines, floor heights, window sizes, roof line, or other outside dimensions. Elevations are shown on all faces of a structure.)

B. Floor plan (Transparency 3)

(NOTE: Characteristics include layout or arrangement of each floor, room, or section of a building. The plan view gives the observer a picture of the view he/she would get if looking down on the floor from above.)

C. Section (Transparency 4)

(NOTE: Characteristics include cut-away drawings of hidden parts such as stairs, walls, chimneys, wall thickness at various parts, anchors, and bonds. In the sectional view the cut is usually made vertically and is limited to the specific portion of the building the architect wishes to clarify.)

D. Construction and/or scale detail (Transparency 5)

(NOTE: Characteristics include detail construction of a particular item that is very complicated. These drawings are primarily used to depict details of construction that are too small or are not shown in sufficient detail on the plan or elevation drawing. They may be full size or to a larger scale than the plan, elevation, or sectional view.)

E. Site plan (Transparency 6)

(NOTE: Characteristics include location and reference point on site.)

III. Divisions found in building plans

A. Architectural division

1. Site plan
2. Location of building on lot
3. Floor plans
4. Elevations

INFORMATION SHEET

B. Structural division

1. Framing
2. Roof framing
3. Steel work
4. Floor framing

C. Mechanical and electrical division

1. Heating
2. Air conditioning
3. Water and sewage
4. Electrical layouts

(NOTE: If the building is not elaborate, the architect may combine the sections so that the floor plan will include information on framing, mechanical equipment, and electrical wiring.)

IV. Lines that may be found on a drawing (Transparency 7)

A. Object

(NOTE: These show the main outline of the structure including exterior walls, interior partitions, porches, patios, driveways, and interior walls. These lines should be the outstanding lines on the drawing.)

B. Dimension

(NOTE: These thin unbroken lines designate dimensions.)

C. Extension

(NOTE: They extend but do not touch the object lines and permit dimension lines to be drawn between them.)

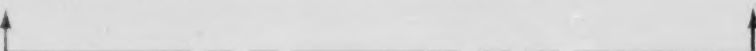
D. Hidden

(NOTE: Short dashes are used to show lines that are not visible from that view.)

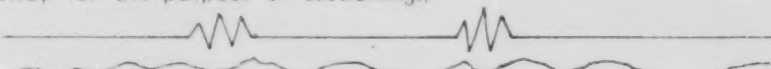
INFORMATION SHEET

E. Center ————

(NOTE: A series of short and long dashes are used to designate centers and provide a reference point for dimensioning.)

F. Section 

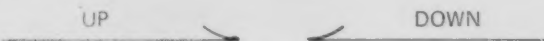
(NOTE: These are heavy lines consisting of a series of one long and two short dashes with arrows at each end pointing away from the area that is cut away for the purpose of sectioning.)

G. Break 

(NOTE: These lines are used when an area cannot or should not be drawn entirely.)

H. Leader 

(NOTE: The lines are used to connect a note or dimension to a part of the building.)

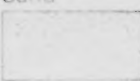
I. Stair indicator 

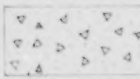
(NOTE: These lines indicate the direction of stairs.)

V. Drawing symbols (Transparency 8)

(NOTE: A set of plans usually contains a "legend" which identifies symbols used.)

A. Earth 

B. Sand 

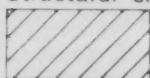
C. Concrete 

D. Steel 

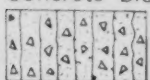
E. Brick 

INFORMATION SHEET

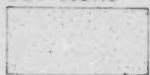
F. Structural clay tile



G. Concrete block



H. Cut stone



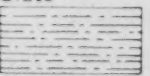
I. Cast stone



J. Marble



K. Slate



L. Plywood



M. Wood, rough



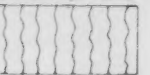
N. Wood, finished



O. Plaster



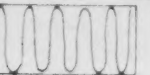
P. Ceramic tile



Q. Insulation board, quilt



R. Insulation batts or fill



INFORMATION SHEET

VI. Commonly used abbreviations

A. Anchor bolt--AB	Y. Partition--PTN
B. Angle-- 	Z. Plaster--PLAS
C. Architectural terra cotta--ACT	AA. Plate glass--PL GL
D. Bench mark or beam--BM	BB. Reinforced or reinforcing--REINF
E. Brick--BRK	CC. Section--SECT
F. Caulking--CLKG	DD. Soil pipe--SP
G. Cast iron pipe--CIP	EE. Stone--STN
H. Cast stone--CS	FF. Top of curb--TC
I. Catch basin--CB	GG. Wall vent--WV
J. Center to center--C to C	HH. Weatherproofing--WP
K. Channel-- 	II. Weep hole--WH
L. Cinder block--CIN BL	JJ. Window--WDW
M. Column--COL	KK. Footing--FTG
N. Concrete block--CONC B	LL. Foundation--FND
O. Brick course--C	MM. Glass block--GL BL
P. Cross section--X-SECT	NN. Grade--GR
Q. Dampproofing--DP	OO. I-beam--I
R. Elevation--EL	PP. Limestone--LS
S. Expansion joint--EXP JT	QQ. Manhole--MH
T. Facing tile--FT	RR. Marble--MR
U. Firebrick--FBRK	SS. Masonry opening--MO
V. Finished grade--FG	TT. Modular--MOD
W. Fireplace--FP	UU. On center--OC
X. Flashing--FL	VV. Opening--OPNG

INFORMATION SHEET

VII. Architect's scale (Transparencies 9 and 10)

A. Rules for reading a scale

1. Select proper scale ratio
2. Be sure scale is laying flat on the surface being measured
3. Double check all measurements
4. Practice measuring from the center of one line to the center of the next line
5. Do not use a scale where dimensions are available

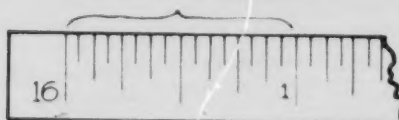
B. Common scales to which plans are drawn

1. $1/8" = 1' 0"$
2. $1/4" = 1' 0"$
3. $1/2" = 1' 0"$
4. $3" = 1' 0"$ (One-fourth scale)
5. $6" = 1' 0"$ (One-half scale)
6. $12" = 1' 0"$ (Full scale)

C. Interpreting graduations on the architect's scale

(NOTE: When measuring, be sure to use the specific scale on the architect's scale.)

1. Sixteenth scale (full scale)
 - a. 16 - 16ths make one inch



INFORMATION SHEET

- b. 8 - 8ths make one inch; 2 - $1/16''$ make $1/8''$



- c. 4 - 4ths make one inch; 4 - $1/16''$ make $1/4''$



- d. 2 - $1/2$ ves make one inch; 8 - $1/16''$ make $1/2''$



- e. For $1/32''$ increments there are two $1/32''$ in one $1/16''$ and two $1/16''$ in one $1/8''$

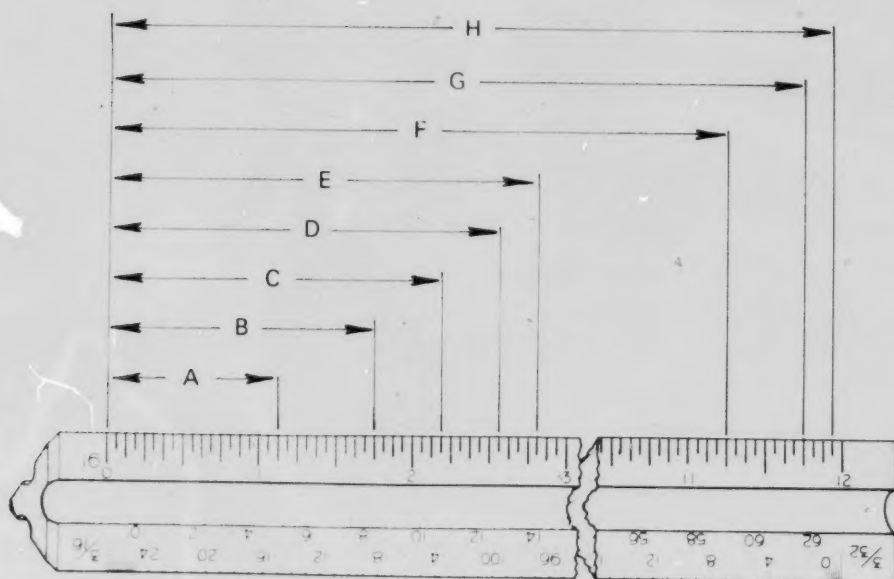


- f. Dimensions are read in this order

- 1) Feet marked thus (')
- 2) Inches marked thus (")
- 3) Fractions of an inch

INFORMATION SHEET

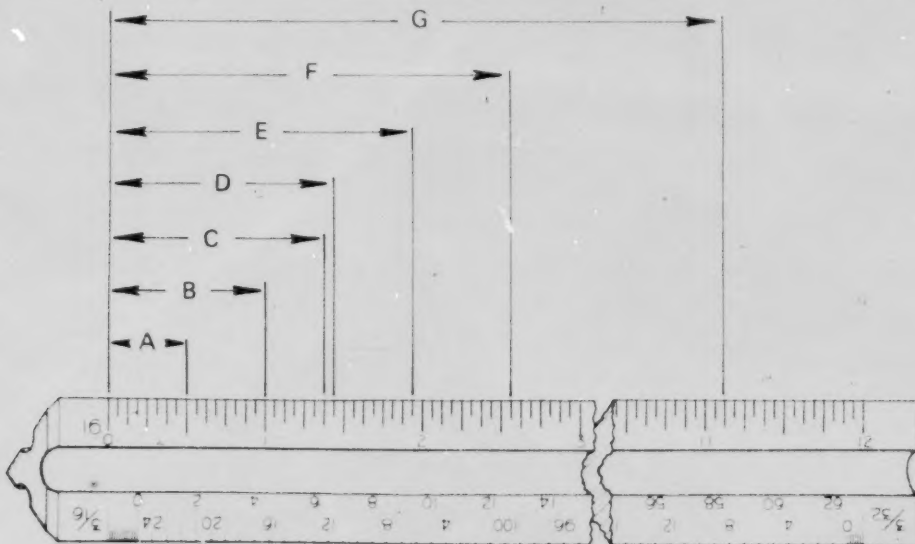
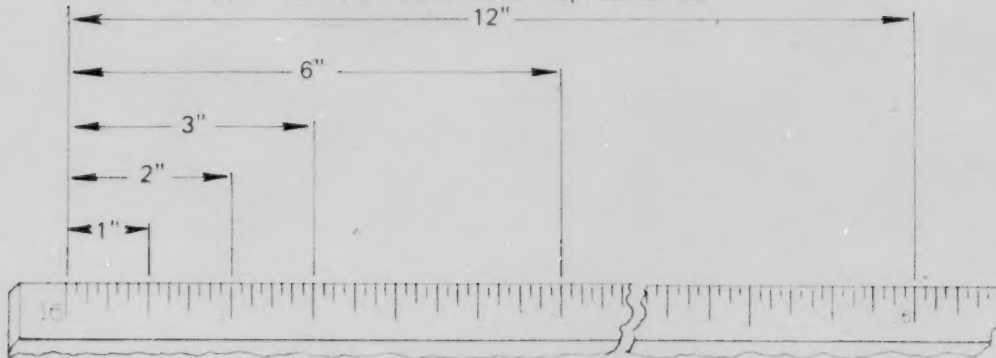
- g. Practice reading the following dimensions in inches and 1/16" (full scale)



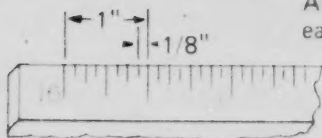
- 1) $A = 1'' + 2/16'' = 1 \frac{2}{16}''$ or $1 \frac{1}{8}''$
- 2) $B = 1'' + 12/16'' = 1 \frac{12}{16}''$ or $1 \frac{3}{4}''$
- 3) $C = 2'' + 3/16'' = 2 \frac{3}{16}''$
- 4) $D = 2'' + 9/16'' = 2 \frac{9}{16}''$
- 5) $E = 2'' + 13/16'' = 2 \frac{13}{16}''$
- 6) $F = 11'' + 4/16'' = 11 \frac{4}{16}''$ or $11 \frac{1}{4}''$
- 7) $G = 11'' + 12/16'' = 11 \frac{12}{16}''$ or $11 \frac{3}{4}''$
- 8) $H = 11'' + 15/16'' = 11 \frac{15}{16}''$

INFORMATION SHEET

2. One-half scale or 6" represents 12"

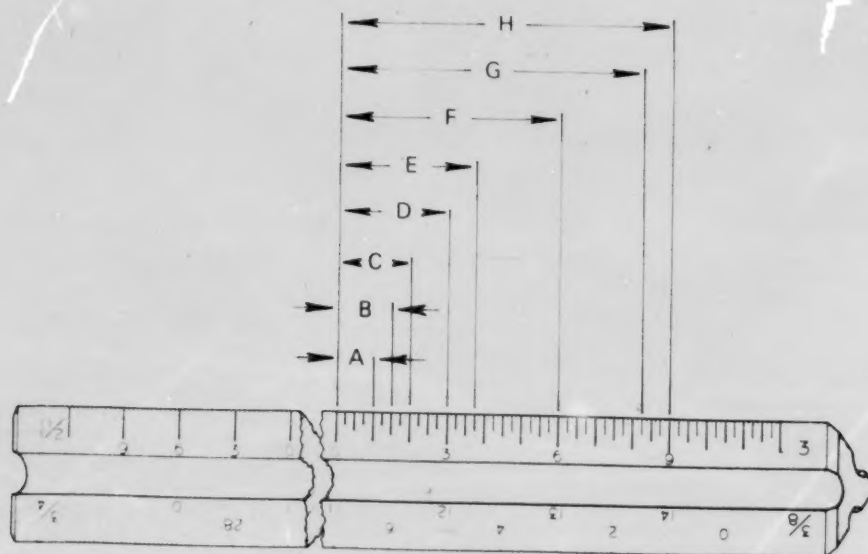
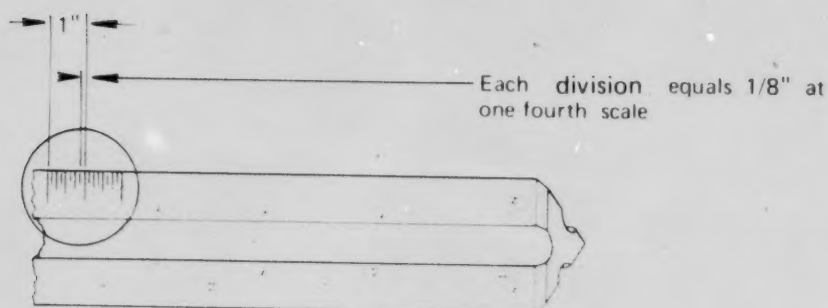
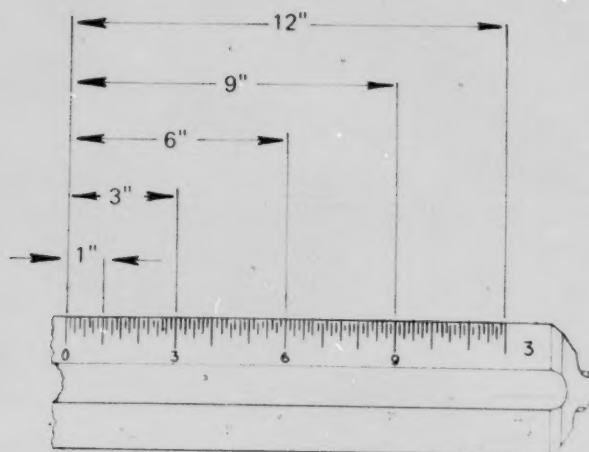


At half scale the $1/16''$ graduations
each represent $1/8''$



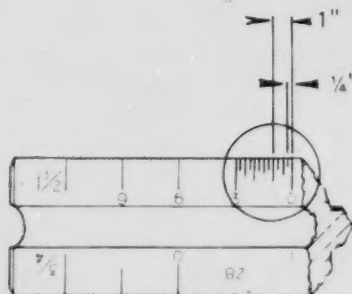
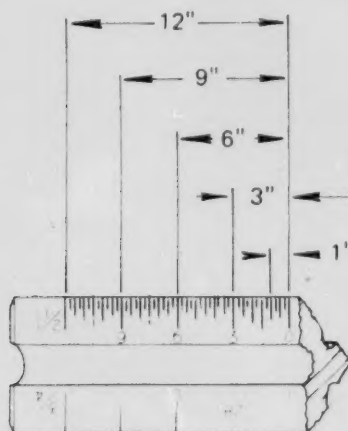
- a. $A = 8/8'' = 1''$
- b. $B = 16/8'' = 2''$
- c. $C = 2'' + 6/8'' = 2 \frac{6}{8}''$ or $2 \frac{3}{4}''$
- d. $D = 2'' + 7/8'' = 2 \frac{7}{8}''$
- e. $E = 3'' + 7/8''$ or $3 \frac{7}{8}''$
- f. $F = 5'' + 1/8'' = 5 \frac{1}{8}''$
- g. $G = 22'' + 2/8'' = 22 \frac{2}{8}''$ or $22 \frac{1}{4}''$

INFORMATION SHEET

3. One-fourth scale or $3'' = 12''$ 

INFORMATION SHEET

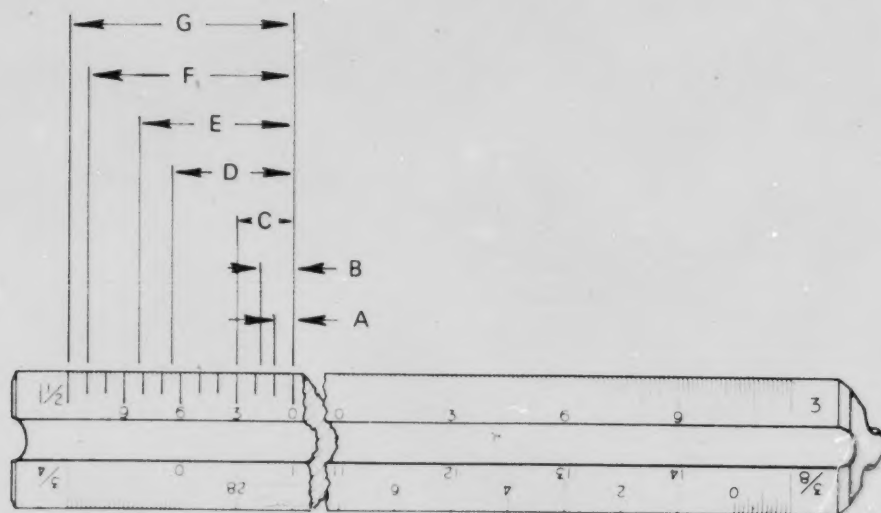
- a. $A = 8 \text{ graduations} = 1''$
 - b. $B = 1'' + 4/8'' = 1 \frac{4}{8}''$ or $1 \frac{1}{2}''$
 - c. $C = 1'' + 8/8'' = 1 \frac{8}{8}''$ or $2''$
 - d. $D = \text{The number } 3 = 3''$
 - e. $E = 3'' + 6/8'' = 3 \frac{6}{8}''$ or $3 \frac{3}{4}''$
 - f. $F = \text{The number } 6 = 6''$
 - g. $G = 8 + 2/8'' = 8 \frac{2}{8}''$ or $8 \frac{1}{4}''$
 - h. $H = \text{The number } 9 = 9''$
4. One-eighth scale or $1 \frac{1}{2}'' = 12''$



This is one inch at 1/8" scale
graduated into spaces that represent
1/4"

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INFORMATION SHEET



- a. $A = 8 \text{ graduations} = 1''$
- b. $B = 1'' + 3/4'' = 1 \frac{3}{4}''$
- c. $C = \text{The number } 3 \text{ represents } 3''$
- d. $D = 6'' + 2/4'' = 6 \frac{2}{4}'' \text{ or } 6 \frac{1}{2}''$
- e. $E = 8 + 1/4'' = 8 \frac{1}{4}''$
- f. $F = 2'' \text{ past } 9 \text{ represents } 11''$
- g. $G = 1 \frac{1}{2}'' \text{ represents } 12''$

VIII. Items found on a structural drawing

- A. Heights of finished floors and walls
- B. Height and bearing of bar joist or steel joist
- C. Locations of bearing steel
- D. Heights of steel beams, concrete plank, concrete Ts and poured-in-place concrete
- E. Bearing plate locations
- F. Reinforcing steel drawings and schedules showing spacing and sizes

INFORMATION SHEET

- G. Anchor bolt locations
 - H. Size of bolts and spacing
 - I. Solid masonry units grouting or block filled solid with mortar
 - J. Steel stairs
- IX. Items found in a set of masonry specifications
- A. Notice to sub-bidders
 - B. General outline of work to be performed
 - C. Mortar materials
 - D. Mortar mixing
 - E. Face brick type, sizes, and allowance per M
 - F. Flue linings
 - G. Back-up brick
 - H. Concrete masonry units
 - I. Concrete block specifications
 - J. Sample panels and coursing information
 - K. Flashing, types of material, and installation
 - L. Masonry layout
 - 1. Bond pattern
 - 2. Mortar joint and type of jointer needed
 - 3. Laying brick in warm weather and cold weather
 - 4. Back-up information
 - 5. Staging, level courses, filled solid and parging
 - 6. Corbeling
 - 7. Joint reinforcing
 - 8. Interior block partitions

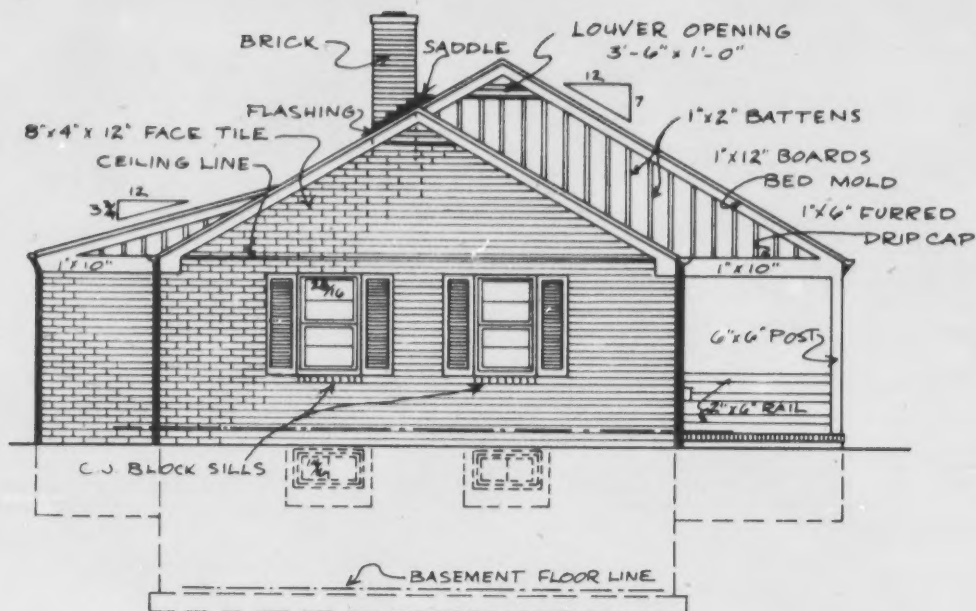
INFORMATION SHEET

- 9. Insulation on steel columns
- 10. Weep holes
- 11. Bearing walls
- M. Limestone sills
- N. Reinforcing in block walls and partitions
- O. Chimney
- P. Anchors and wall ties
- Q. Sleeves in masonry walls
- R. Handling of brick and block
- S. Control joints
- T. Cutting and patching
- U. Pointing and cleaning down
- V. Setting of ironwork and grilles
- W. Removal and alteration work
- X. Fire protection
- Y. General protection
- Z. Cold weather protection
- AA. Temporary heat
- BB. Clarifications
- X. Items usually shown in detail on a drawing
 - A. Flashing
 - B. Weep holes
 - C. Anchor bolts and anchors
 - D. Window and door heights
 - E. Tops of walls

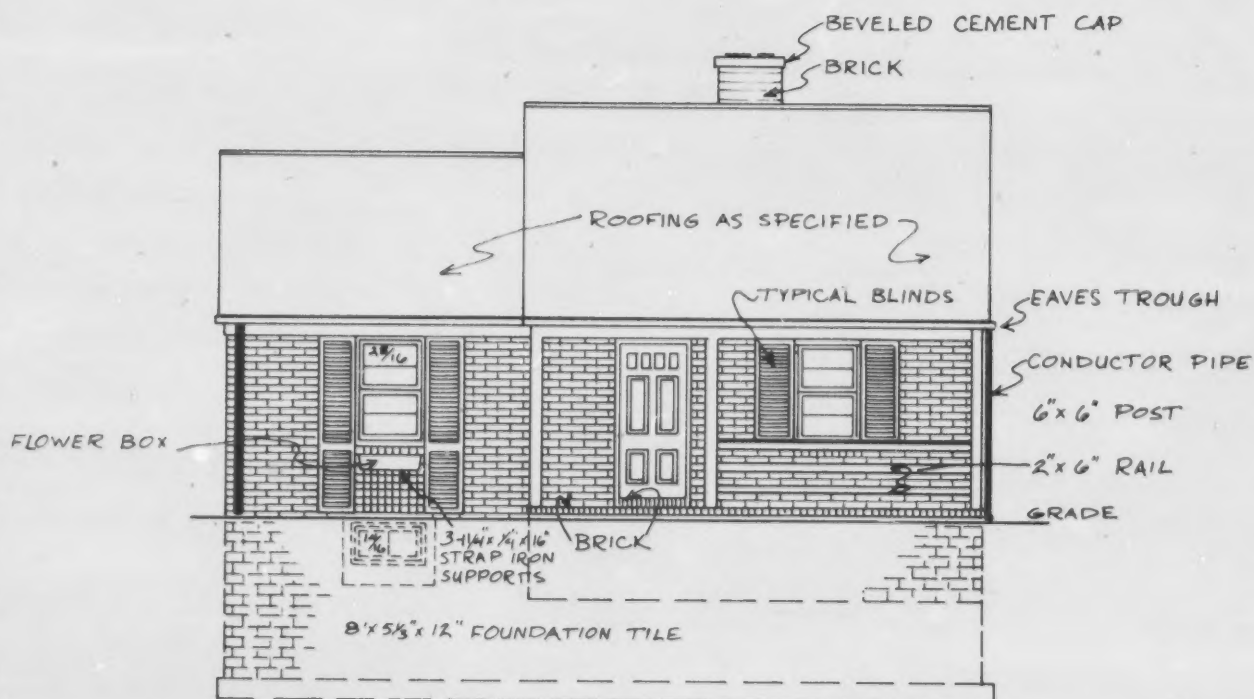
INFORMATION SHEET

- F. Floor heights, thickness, and reinforcing
- G. Types of lintels
- H. Sill heights and types of sills
- I. Wood blocking
- J. Steel beams and joist bearing
- K. Roof heights
- L. Gravel stop and fascia
- M. Expansion joints
- N. Face of walls
- O. Back-up
- P. Metal ties
- Q. Ceiling heights
- R. Footings and foundations
- S. Waterproofing
- T. Polyethylene film
- U. Compaction
- V. Sizes of reinforcing steel
- W. Insulation
- X. Caulking

Elevation Section



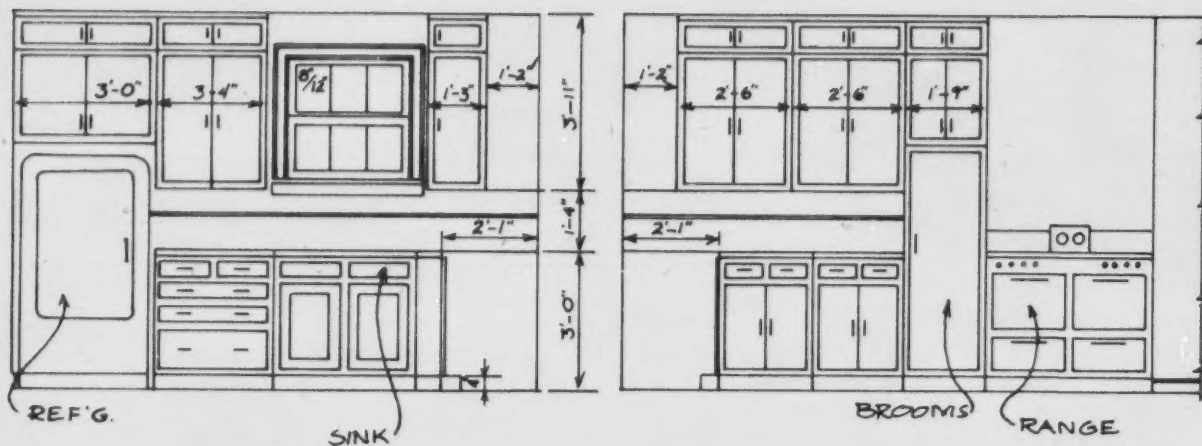
Left side elevation of residence



Typical front elevation of a residence

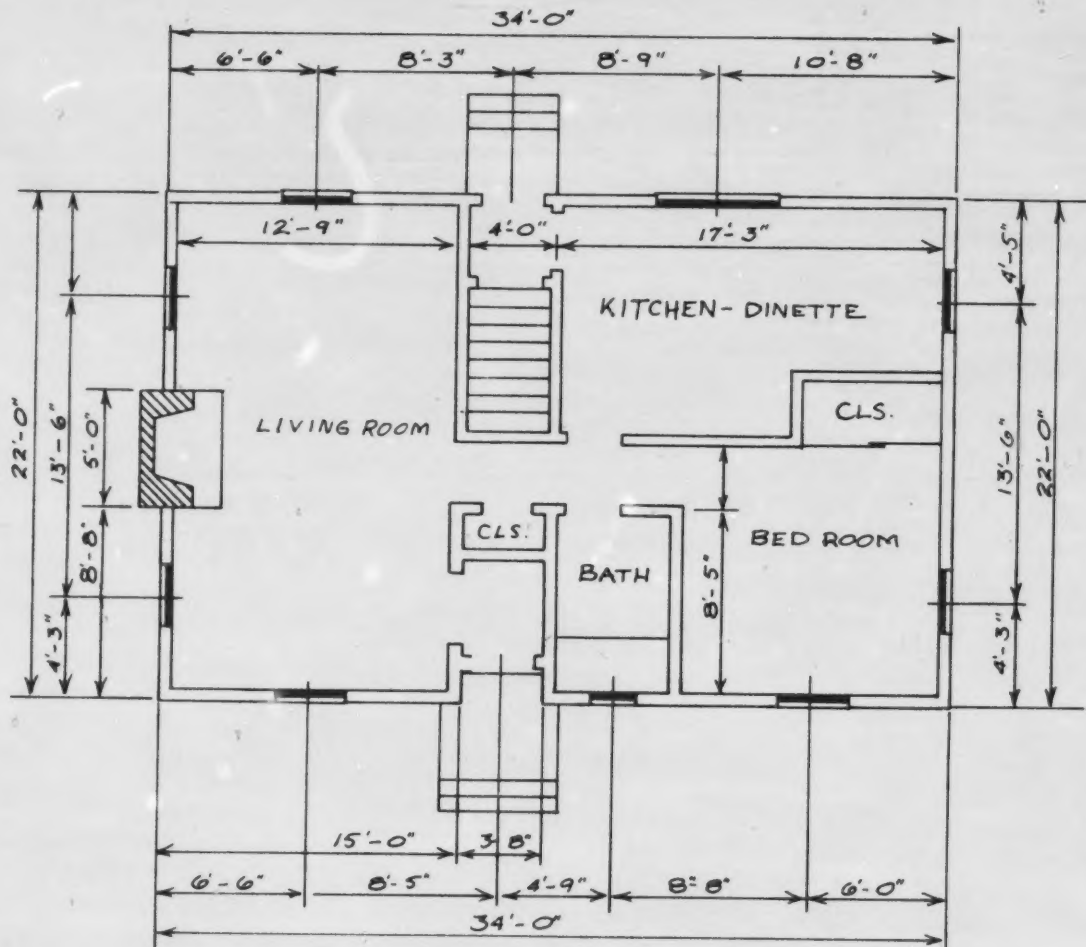
Elevation Section

(Continued)



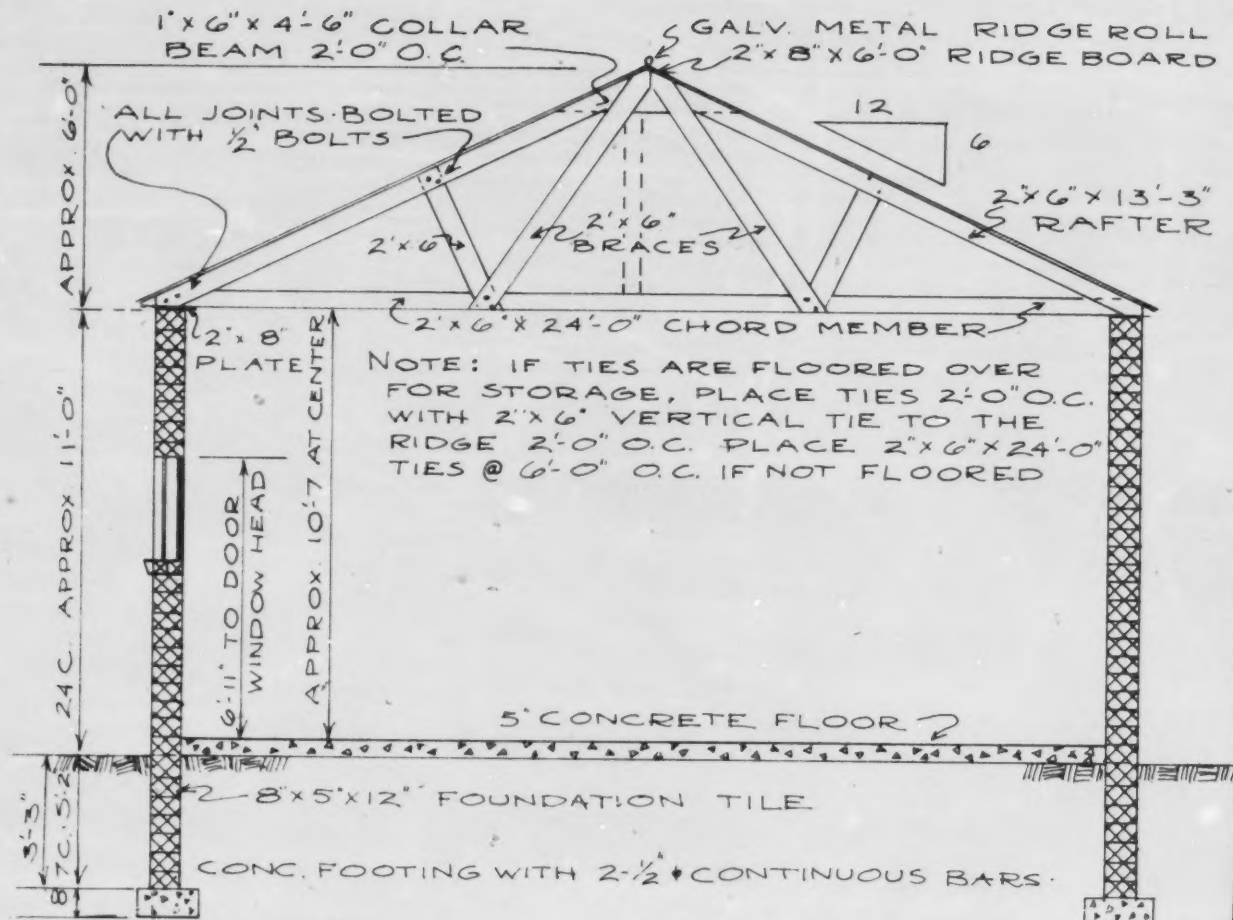
Kitchen wall elevations

Floor Plan



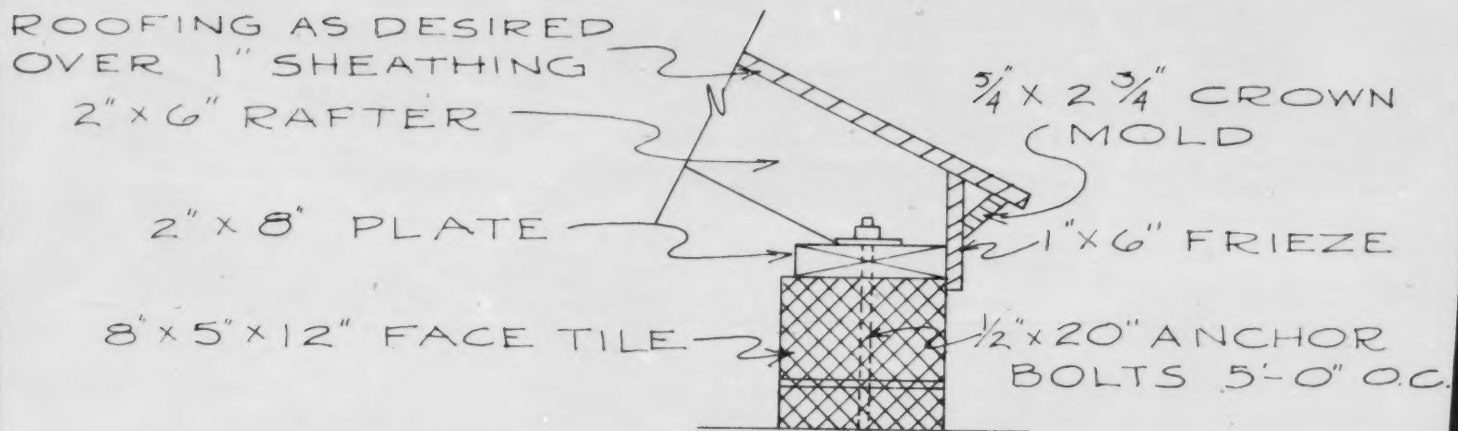
The plan view resulting from previous drawings

Section View



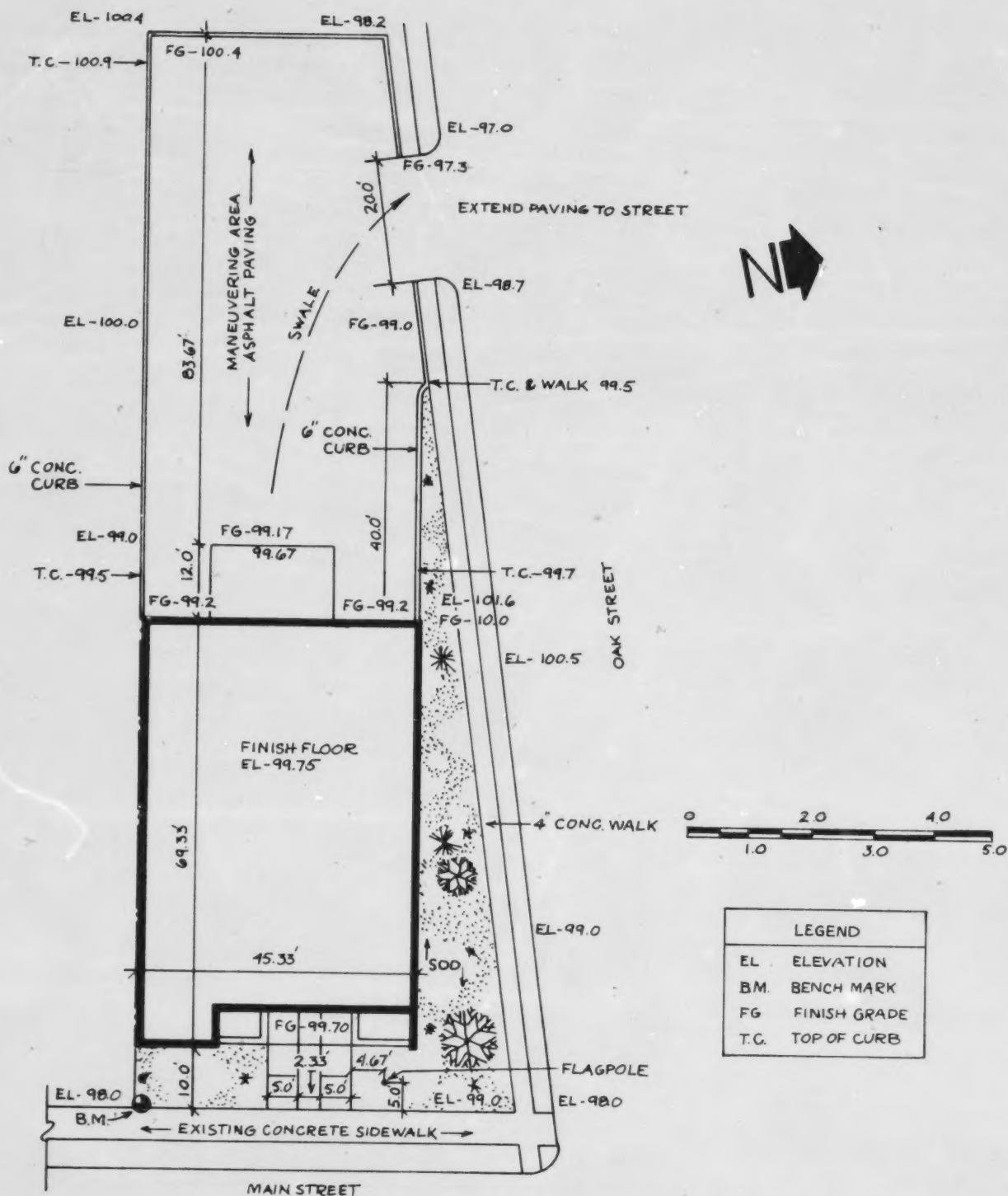
Cross sectional view through the walls of a small building

Construction or Scale Detail



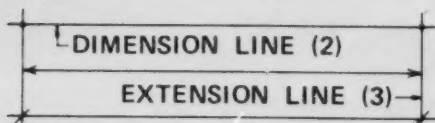
A scale detail of a cornice at the connection
of a roof to a masonry wall

Site Plan



Lines On a Drawing

1. MAIN OBJECT LINE



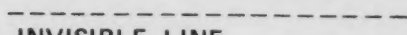
2 & 3. DIMENSION & EXTENSION LINE



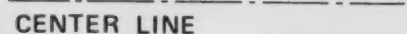
4. BROKEN LINE



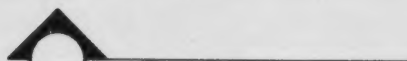
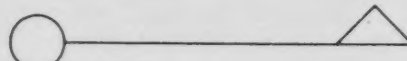
5. INVISIBLE LINE



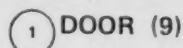
6. CENTER LINE



7. STAIR INDICATOR



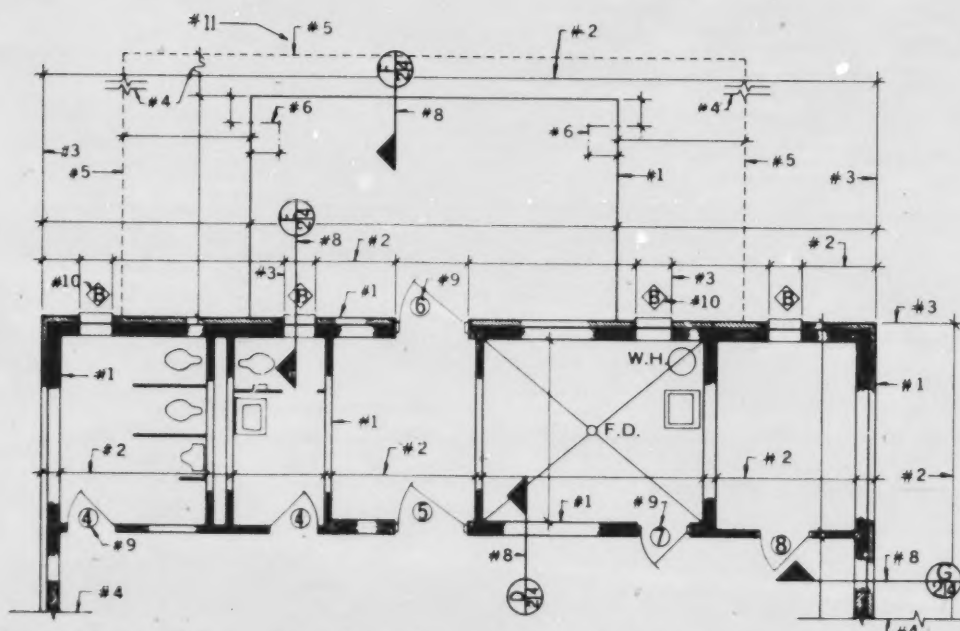
8. VARIOUS SECTION INDICATIONS



9 & 10. DOOR & WINDOW SCHEDULE MARK

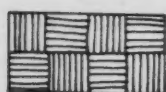


11. LEADER LINE



Typical working drawing floor plan showing each type of line

Drawing Symbols



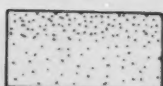
Earth



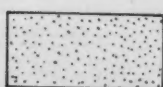
Concrete Block



Wood, Rough



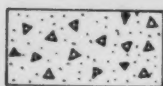
Sand



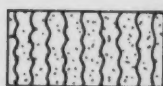
Cut Stone



Wood, Finished



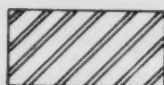
Concrete



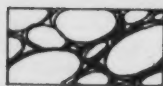
Cast Stone



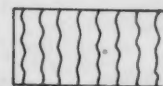
Plaster



Steel



Marble



Ceramic Tile



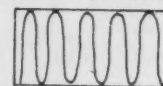
Brick



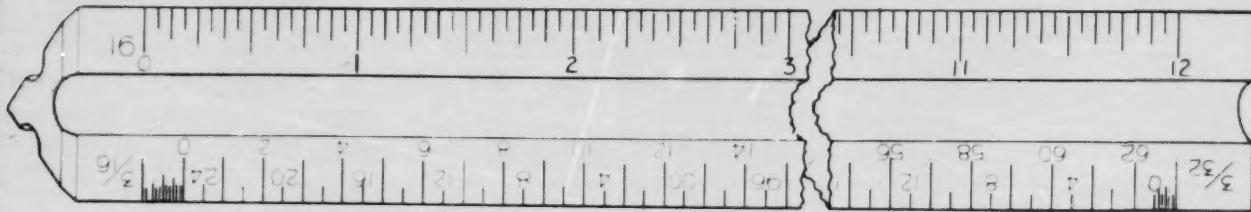
Slate

Insulation
Boards, QuiltsStructural
Clay Tile

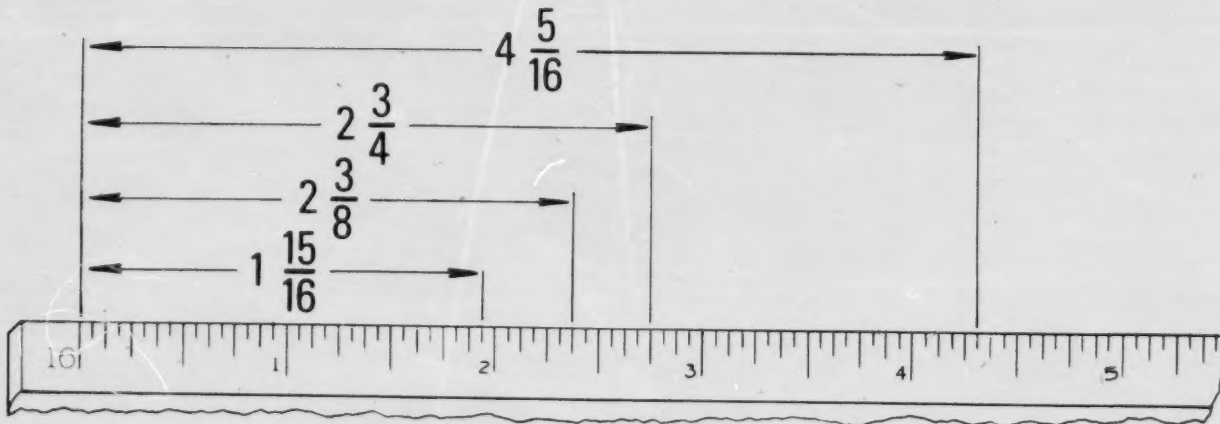
Plywood

Insulation
Batts or Fill

Architect's Scale

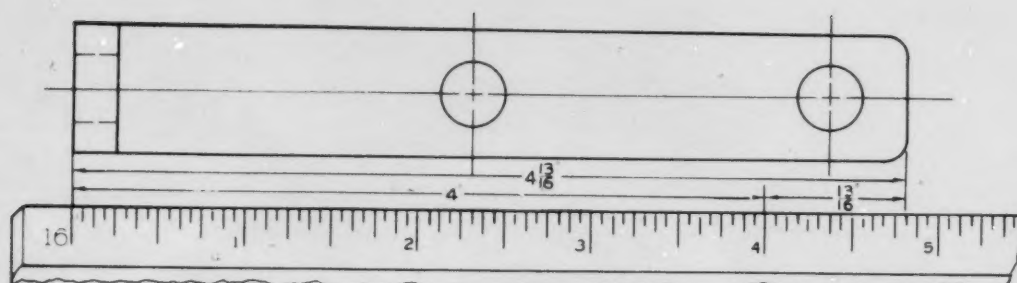


This is how the Architect's Scale should look.

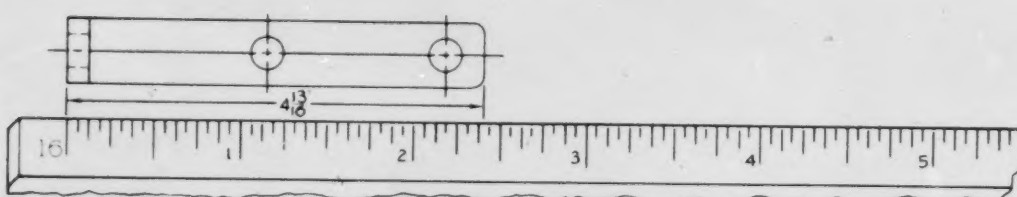


Measurements at Scale of 12" = 1'-0"

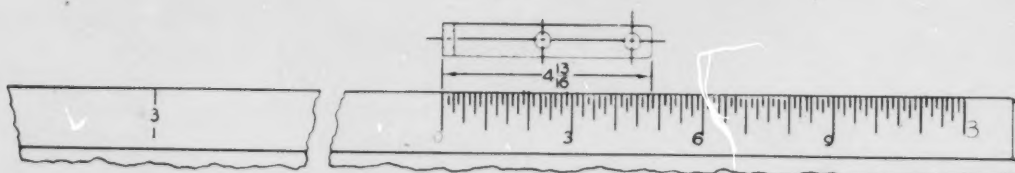
Comparison of Solid Objects



Full Scale 12" = 1'-0"



Half Scale 6" = 1'-0"



One-Fourth Scale 3" = 1'-0"

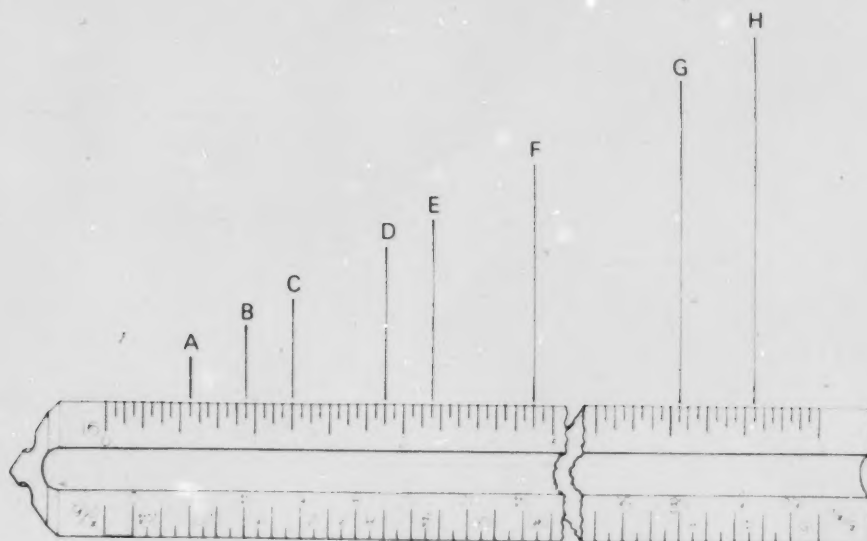


One-Eighth Scale 1 1/2" = 1'-0"

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #1--READ THE ARCHITECT'S SCALE
USING FULL SCALE (12" = 12")

Read the measurements shown below at full scale by reading the distance from "0" at left to points indicated on the scale with letters.

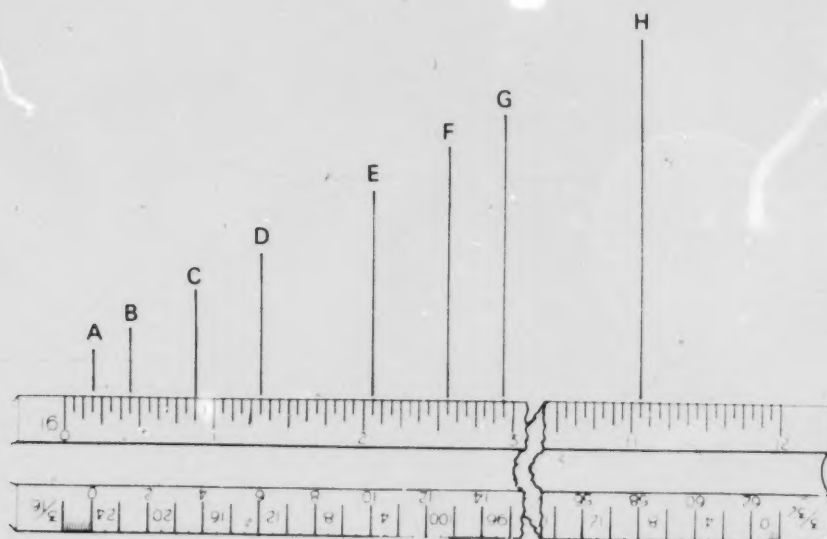


1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BASIC BLUEPRINT READING UNIT II

ASSIGNMENT SHEET #2--READ THE ARCHITECT'S SCALE USING HALF SCALE (6" = 12")

Read the measurements shown below at half scale by reading the distance from "0" at left to points indicated on the scale with letters.

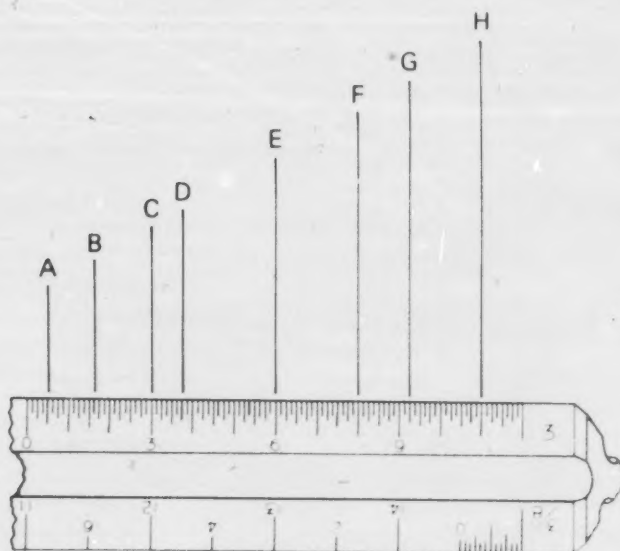


1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #3--READ THE ARCHITECT'S SCALE
USING ONE-FOURTH SCALE (3" = 12")

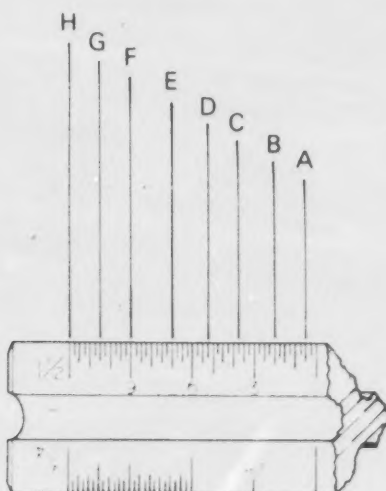
Read the one-fourth scale shown below by reading the distance from "0" at left to points indicated on the scale with letters.



1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BASIC BLUEPRINT READING
UNIT IIASSIGNMENT SHEET #4-READ THE ARCHITECT'S SCALE
USING ONE-EIGHTH SCALE ($1\frac{1}{2}" = 12"$)

Read the one-eighth scale shown below by reading the distance from "0" at right to points indicated on the scale with letters.



1. A =
2. B =
3. C =
4. D =
5. E =
6. F =
7. G =
8. H =

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #5--READ A BLUEPRINT

Using the plans on the following pages, answer the questions below.

Site Plan--Sheet #1

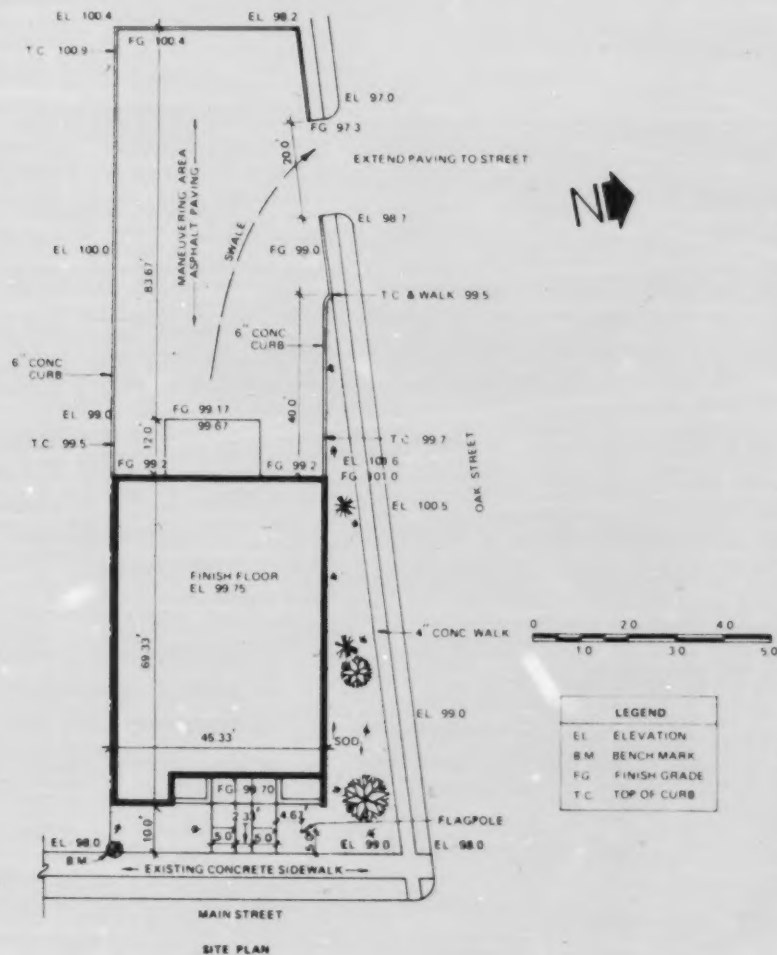
1. What is the outside dimension of the building?
2. Where is the bench mark located?
3. What is the elevation of the finished floor?
4. How much difference is between bench mark elevation and finished floor elevation?

Sheet #2

1. What are the sizes of the windows or masonry openings to be used in this building?
2. How many different types of doors are used in this building?
3. Which rooms have masonry or masonry units on walls or floors?

Sheet #3

1. What type of brick will be used in this building?
2. How many of the outside walls will be brick?



INDEX TO PLANS

- SHEET NO. 1 SITE PLAN
- SHEET NO. 2 FOUNDATION PLAN
FLOOR PLAN
- SHEET NO. 3 ELEVATIONS
- SHEET NO. 4 SECTION DETAILS
ROOF FRAMING PLAN
METAL JAMB DETAILS
- SHEET NO. 5 ELECTRICAL PLAN
MECHANICAL PLAN

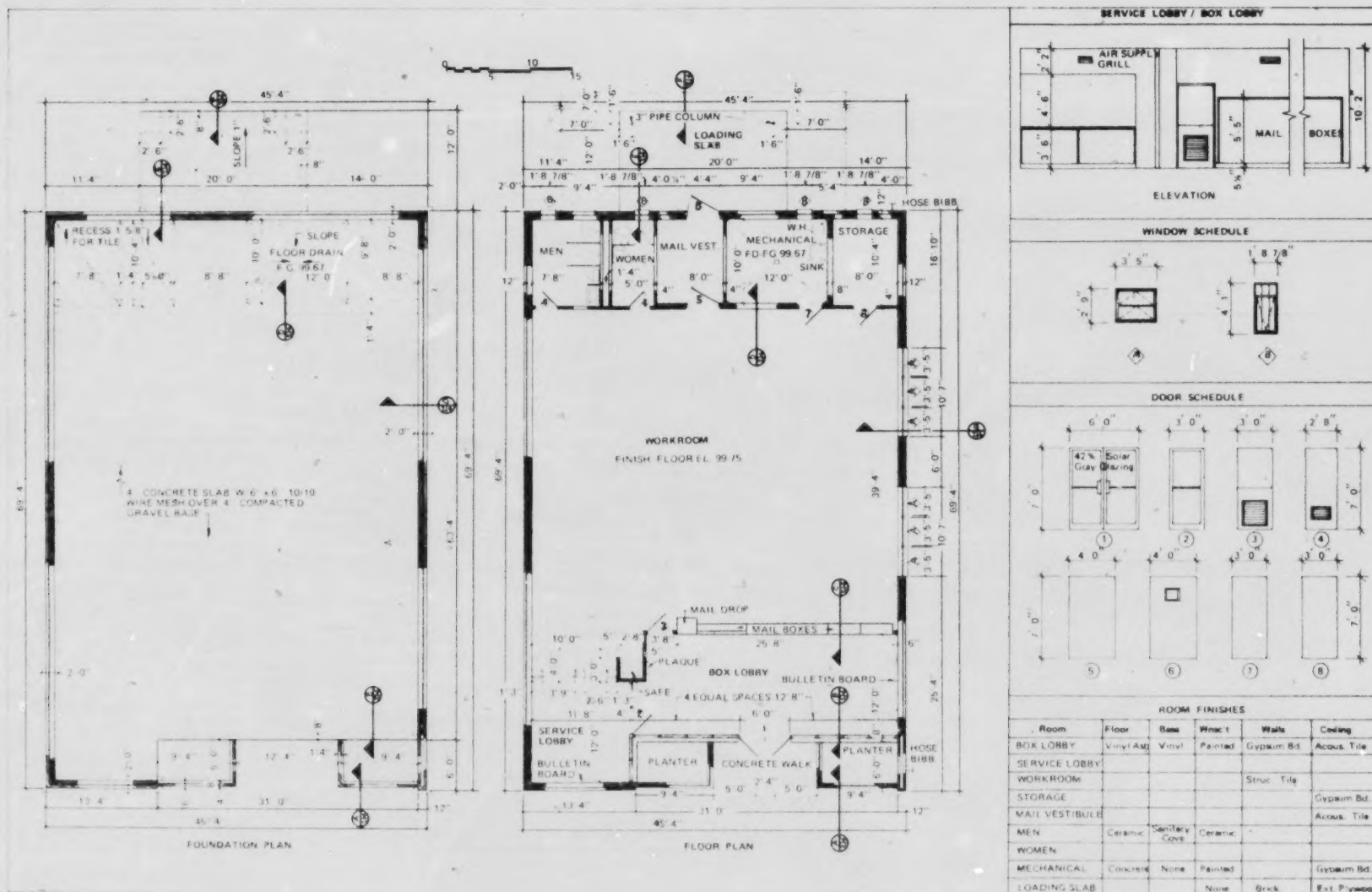
UNITED STATES POST OFFICE BUILDING

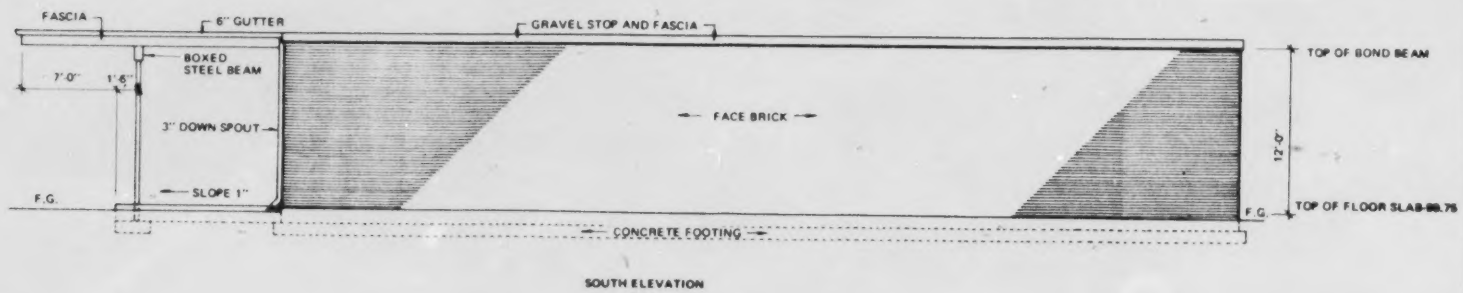
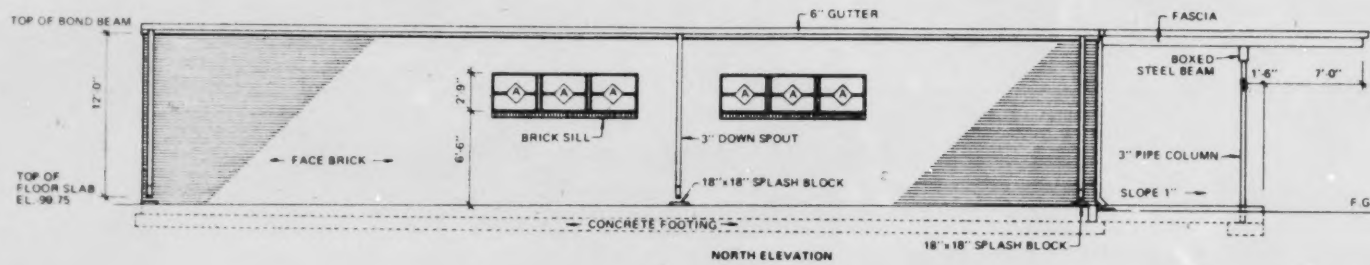
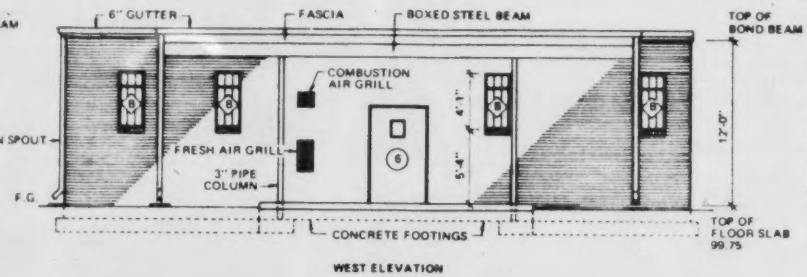
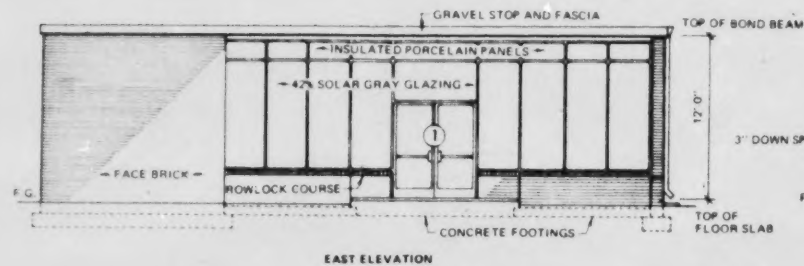
SHEET 1

346

347

76-F





UNITED STATES POST OFFICE BUILDING

SHEET 3

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #6--INTERPRET A SET OF
BRICK MASONRY SPECIFICATIONS

Answer the following questions based on the set of specifications provided.

1. What are the requirements for mixing mortar?
 - a. Machine mixing
 - b. Hand mixing
2. What types of mortar can be used?
 - a. Above grade
 - b. Below grade
3. What must be done with mortar mixed for more than two hours?
4. What size of brick can be used?

ASSIGNMENT SHEET #6

5. What is the maximum dry weight allowed for the following concrete masonry units?
- a. 4" x 8" x 16" _____ wt
- b. 6" x 8" x 16" _____ wt
- c. 8" x 8" x 16" _____ wt
- d. 12" x 12" x 16" _____ wt
6. In section J, Sample Panels and Coursing Information, what is the coursing height of brick?
7. What type of sills should be used?

SAMPLE SET OF SPECIFICATIONS

SECTIONMASONRY WORKA--NOTICE TO SUB-BIDDERS:

1. All bidders are advised that sub-bids for work herein specified shall be filed with the Awarding Authority at time and place stated in the Instructions to Bidders.
2. Work hereinafter specified is shown on Arch. Dwgs. 1 thru 9, Struct. Dwgs. S-1 thru S-6. All other drawings are referred to for coordination of the work.
3. The sub-bidders under this section shall list under paragraph E of the "Form for Sub-Bids" the name and bid price of each person, firm or corporation whom he proposes to use to perform the following work or part thereof as specified therein or shown on the drawings.

CLASS OF WORK
None

REFERENCE PARAGRAPH
None

B--IN GENERAL:

1. This section of the specifications has been prepared based upon having all work performed under the filed bid system. The following is a general outline of work to be performed.
 - a. All brick and block work and all reinforcing and accessories in connection therewith.
 - b. Demolition, cutting and patching of certain existing masonry walls.
 - c. Scaffolding and protection for all masonry work.
 - d. Cleaning of masonry as hereinafter specified, cutting, and patching of masonry.
 - e. Removal of all waste materials and general clean-up.
 - f. All hoisting and conveying equipment required for installation of masonry work.
 - g. All layout work pertaining to masonry.
2. Note all general conditions and requirements of the specifications. Furnish all labor, materials, scaffolding equipment, and supervision required to perform all masonry work as herein specified and shown on the drawings.
3. Samples of materials shall be furnished when requested by the Architect.
4. For approvals of materials see General Conditions.

C--MORTAR MATERIALS:

1. Materials shall be stored and handled so as to prevent damage and deterioration. Manufactured materials such as cement and lime shall be delivered and stored in the original containers and those showing evidence of damage will be wholly rejected and promptly removed from the site.
2. Portland cement shall conform to ASTM Specifications C-150-71 for Type 1 cement. All cement used in mortar shall be light or dark as selected by the Architect.
3. Lime shall be U.S. Mortaseal, Minute Man by Lee Lime Co., or 4X by New England Lime Co., or approved equal, high calcium type, conforming to ASTM Designation C-207-49, Type S and Federal Specifications SS-L-351, Type M (and F) including the added requirements of not more than 8% unhydrated oxides.
4. Sand shall conform to ASTM Specifications Designation C-144-70 for aggregate for masonry mortar.
5. Water used for mixing mortar shall be clean and free from deleterious amounts of acids, alkalies or organic materials.

D--MORTAR MIXING:

1. Mortar shall be mixed by machine except that hand mixing will be allowed for small quantities used when only one mason is employed.
 - a. Machine mixing - Place water for batch in mixer, add half the sand required, add all portland cement, add lime directly from container, add balance of sand. Mixing shall be continuous for a minimum period of three (3) minutes in drum-type mixer.
 - b. Hand mixing - Mix dry ingredients in box and cut together at least three (3) times. Add water as needed to obtain proper plasticity.
2. Mortar made from materials complying with the above specifications shall be mixed in proportions as follows:
 - a. Above grade - 1 part portland cement, 2 parts hydrated lime, 7 parts sand (1:2:7).
 - b. Below-grade - or bearing piers less than 5' 0" wide: 1 part portland cement, 1 part hydrated lime and 5 parts sand (1:1:5).
3. Mortar which has been mixed for more than two (2) hours shall be discarded. Retempering with additional water shall be kept to a minimum. No change in the previously approved brands will be allowed after laying of face brick has started. All proportions shall be by volume and may be varied slightly to obtain a consistency satisfactory to the Architect. Enough water shall be used to produce a plastic mortar which will allow the laying of shoved joints.

E--FACE BRICK:

1. Exterior walls shown on floor plans and elevations as brick shall have face brick of standard sizes made from clay or shale to reasonably match existing which are reported to be General Clay #252 Aristocrat Blend Mat. These bricks shall be furnished and delivered to job site and stacked in truck load lots where directed by this sub-contractor under an allowance.
 - a. Allowance for exterior face brick \$130.00 per M.
 - b. Allowance for interior face brick \$200.00 per M.
2. Brick required for fill-in and patching on the interior shall also be new and shall match existing. Reuse of existing interior face brick is also acceptable.

F--FLUE LININGS:

1. Flue linings for two (2) chimney flues shall be terra cotta, of proper sizes.

G--BACK-UP BRICK:

1. Where block cannot be used for back-up, brick shall be used. Brick shall be sand-lime or burned clay common brick and shall conform to the Standard Specifications for the ASTM C-73-67 for sand-lime brick and ASTM C-62-69 for solid clay masonry unit.
2. Second-hand brick shall not be used unless special permission in writing is given by the Architect.
3. The brick shall be uniformly of the same grade and free from warped and otherwise misshapen units. Where exposed on interior walls, they shall be selected and free from chipped corners and cracks.

H--CONCRETE MASONRY UNITS:

NOTE: The use of the terms "Concrete Block" and "Concrete Masonry Units" on drawings or in these specifications are interchangeable and refer to units having aggregates as herein specified.

1. Concrete blocks shall conform to the following specifications:
 - a. Solid load-bearing units ASTM Designation C-145-70, Type I, Grade G-1.
 - b. Hollow load-bearing units ASTM Designation C-90-70, Type I, Grade G-1.
 - c. Hollow non-load-bearing units ASTM Designation C-129-70, Type I, Grade G-1.

NOTE: "Type I" refers to Moisture Control.

2. For the purpose of clarification of item a-Solid Load Bearing, the net cross sectional area of the unit in every plane parallel to the bearing surface shall be not less than 75% of its cross-sectional area measured in the same plane.
3. Concrete blocks shall be of the following nominal sizes: 2", 4", 6", 8", 10", or 12" x 8" x 16" or 18". Concrete blocks shall be held in storage for at least 28 days before delivery.
4. The aggregate shall be one of the following manufactured materials or approved equal:
 - a. Aggregate as manufactured by Masslite, Inc., and used in masonry units according to Masslite Lightweight Aggregate Specifications for Masonry Units, and in accordance with ASTM Specifications C-90-70. The blending of stone screening-in with this aggregate is strictly prohibited. Maximum dry weight per masonry unit shall be as follows:

4" x 8" x 16"	19 lbs
6" x 8" x 16"	21 lbs
8" x 8" x 16"	28 lbs
12" x 12" x 16"	42 lbs

All other sizes shall be of corresponding maximum dry weight.

- b. or aggregate as manufactured by Solite Corp. This aggregate shall be produced by rotary kiln process and shall be graded according to ASTM Specifications C-331-69. The weight of the concrete used in production of block shall not exceed 95 lbs per cubic foot, as tested in accordance with ASTM Specifications C-140-70. The blending of the stone screening in with this aggregate is strictly prohibited. The maximum weight of these units shall not exceed that specified in sub-paragraph (a) above.
5. All units shall be sound and free from cracks or other defects which would interfere with proper placing of the units or impair the strength or permanence of construction. The texture shall be smooth, suitable to receive paint. Submit sample block to the job site for Architect's approval before masonry work starts.
6. All external exposed corners of blocks, except window jambs, shall have one-inch radius and finished ends. Provide header blocks where blocks are used as back-up in masonry walls. Also provide lintel blocks as called for on drawings.
7. All blocks in walls and partitions shall be laid up in running bond and all intersections of walls and partitions shall be bonded with blocks in alternate courses. Where blocks about concrete, provide dovetail slots and hooked galvanized metal anchors 12" long, spaced every third course; dovetail-type anchors shall be used where dovetail slots have previously been inserted into the concrete. Anchors, without dovetail inserts shall be secured with one Ramset type 1/4" #20 bolt.

8. Under beams resting on concrete blocks, build bearing as called for on structural drawings, using solid block units.
9. All masonry partitions as noted on drawings shall extend to the underside of the roof construction to form a fire stop.

I--

J--SAMPLE PANELS & COURSING INFORMATION:

1. Sample panels not required. Coursing and jointing shall match those in the existing building.
2. Attention is called to the fact that coursing in the original building is three brick courses equal 7 7/8", whereas the coursing in the 1968 addition is three brick courses equal 8", therefore, new unit "C" shall be laid up three brick courses equal 8". All other units shall be laid up three courses at 7 7/8".

K--FLASHINGS:

1. All copper and fabric flashing will be installed by the sub-contractor for the roofing and flashing and waterproofing. This contractor shall prepare the masonry bed, including freshly placed mortar under all copper flashing. It shall be the responsibility of the General Contractor to ascertain that all fabric flashing is properly formed and sealed with mastic and metal flashing properly formed and soldered as the work progresses.

L--LAYING OF MASONRY:

1. Exterior face brick with masonry backing is to be laid with a running bond consisting of five rows of stretchers and one row of alternate headers and stretchers every sixth course. Exterior face brick laid against cast-in-place concrete shall have "snapped" alternate headers and regular stretchers in every sixth course and be anchored to the concrete with dovetailed type galvanized metal ties.
2. The joints of all exterior face brickwork shall be steel tooled to weathered joints for horizontals and flush for verticals. Mortar joints for interior work shall be steel tooled to flush or concave joint as approved by the Architect.
3. Brick laid in warm weather shall be sprinkled with water well in advance of being installed and the stockpiles shall be kept covered with tarpaulins in order to retain a suitable moisture content. In cold weather, brick stockpiles shall be kept dry by covering as specified above. Brickwork may start on a rising temperature of 34 degrees F. and must be stopped on a falling temperature of 36 degrees F.
4. The back-up and face brick for all masonry walls are to be carried up as near as possible to the same level as the work progresses. Toothing is definitely prohibited; this requirement will be enforced.

5. All face brickwork is to be laid from a stage with no brick laid overhand. All brickwork shall be laid with true and level courses with shoved joints solid and full of mortar. At jambs the space between face brick and back-up materials shall be filled solid for a distance of 8" in length. Parge the back of all face brick 3/8" thick before laying backing.
6. Corbel or set back walls as required for steel bases, concrete slabs, ventilating ducts and other construction. Build piers and supports as required by heating apparatus and piping. Do all cutting and patching for other trades and leave or cut all required chases shown or necessary for all piping and conduits and make tight around same.
7. All interior masonry units in walls and partitions shall be laid with metal joint reinforcing as hereinafter specified. Running bond shall be standard, stack bonds used only if specifically called for on drawings.
8. Blocks for interior partitions and walls and back-up for face brick on exterior shall be laid with special care where these surfaces will be finished with paint or cement base wall coating. Blocks shall be laid in a full bed of mortar, straight, plumb and true, with steel tooled joints of even size. When walls are completed they shall be cleaned and all scale removed and any excessive unevenness shall be rubbed to conform to the texture of an average block, using a coarse carborundum stone. Blocks with damaged surfaces shall not be used in exposed walls; cracks and chipping exceeding one-half square inch will be considered as defects.
9. Where partitions are furred around Lally or steel I columns or special structural supports, the steel itself shall be wrapped with fiberglass insulation in such a way that mortar or blocks cannot touch the column. Furnish 1/2" thick fiberglass blanket for this work.
10. Weep holes shall be provided through exterior masonry walls, located on top of wall flashing and spaced four (4) feet on center. Sash cord #7 shall be cut in 8" lengths and upon completion of masonry work, each piece shall be trimmed flush with the brickwork.
11. All bearing walls shall be constructed to their full width in one operation, including brick and block. This requirement will be enforced.

M--LIMESTONE SILLS:

1. Where called for on drawings furnish and install window sills of Indiana Oolitic Limestone in accordance with the drawings and as hereinafter specified.
2. Materials shall be Indiana Oolitic Limestone building stock, as quarried in Lawrence and Monroe Counties, free from defects that would materially impair its strength, durability or appearance. Stone shall be Standard Grade, buff color in smooth machine finish.

3. Sills shall be cut to shapes shown on drawings and shall be "Slip-Sill" type. Sill shall be set in mortar as specified for other masonry and the top joint against masonry shall be raked out to receive caulking.

N--REINFORCING IN BLOCK WALLS & PARTITIONS:

1. Furnish and install in every 2nd horizontal mortar joint of interior masonry units in interior partitions and walls "Wal-lok" or equal, reinforcing fabricated with two 3/16" diameter 100,000 psi cold drawn steel longitudinal wires with #9 galvanized transverse wires securely welded thereto at 16" or closer centers. Longitudinal wires shall be deformed without loss of strength so as to develop 85% of steel strength when embedded either with or without weld to a depth of 6" in a 3000 lb cement mortar pull-out specimen. Reinforcing shall be designed so that end splices will develop 85% of steel strength without exceeding a mortar joint thickness of 3/8". All reinforcing shall be installed continuous through intersection of walls and partitions with splices lapped at least 5 inches. Also provide reinforcing in every joint, over doors and openings in all walls and partitions, extend reinforcing two (2) feet beyond opening.
NOTE: Reinforcing shall always start on top of the first course above concrete slab.

O--CHIMNEY:

1. Build chimney as shown on drawings. Terra cotta flue linings shall start 3' 0" below breeching inlets and extend to top. Exterior exposed brick shall be face brick. All other brick shall be burned clay brick (no sand and lime brick allowed in the chimney.)
2. Build chimney cap of concrete reinforced with two 1/2" diameter rods.
3. Furnish and install two 12" x 12" cast iron cleanout doors near floor.

P--ANCHORS AND WALL TIES:

1. Furnish galvanized anchors 1/8" x 7/8" and of proper length for anchoring cinder blocks to precast and cast-in-place concrete, as previously specified.
2. Anchors, where dovetail slots are not provided in precast concrete, shall be secured to such precast concrete with "Ramset" type bolts.

Q--SLEEVES IN MASONRY WALLS:

1. This Contractor shall cooperate with the various mechanical trades to the end that all sleeves are properly installed in masonry walls as the work progresses. The various trades will furnish the sleeves and indicate proper location. The cutting of masonry units to properly fit around such sleeves shall be the responsibility of the mason foreman. Pipes not provided with expansion materials around them shall have the spaces between the pipe and sleeve filled solid with masonry mortar.

R--HANDLING OF BRICK, BLOCK, ETC.:

1. All interior and exterior face brick and precast concrete shall be packed on and off trucks and properly piled and covered at the building site.
2. All units must run true to samples and all that do not will be rejected.

S--CONTROL JOINTS:

1. Build in control joints in masonry walls as detailed on drawings. Control joints shall be required in gymnasium as shown on elevations. Similar control joints shall be required throughout the building in any mass of masonry more than 30 feet in length. Obtain correct locations from the Architect before proceeding with masonry work. This requirement will be enforced.

T--CUTTING & PATCHING:

1. Leave chases and cut slots as specified and directed and do all cutting and jobbing connected with masonry for any and all trades and sub-contractors.
2. After the other trades have completed their work, patch and repair as may be necessary to leave all work in first class condition and subject to the Architect's approval.

U--POINTING & CLEANING DOWN:

1. After masonry work is completed, clean down all exposed brickwork with mason's standard muriatic acid diluted with 10 parts water. Wash with fresh water until all surfaces are clean and acceptable.
2. Wash and scrub precast and prefinished masonry units with clean water until all mortar stains and dirt are entirely removed.
3. Wash and scrub exposed cinder and concrete block, removing all lumps, scale, and loose material and leave walls smooth and ready for paint.

V--SETTING OF IRON WORK, GRILLES, ETC.:

1. The mason is to provide proper bed and levels under all iron plates, columns, beams, floor slabs, covers, etc., and shall set all lintels necessary to carry construction.
2. Set and build in all fresh air intakes, wall exhaust louvers, trench, manhole or cleanout covers, chase covers, anchors, brick vents, and pipe sleeves.

NOTE: Fresh air intakes and louvers are furnished and the locations established by the heating sub-contractor. If such intakes and louvers are not available when masonry is built, the heating sub-contractor shall furnish proper measurements for openings and later install these intakes at his own expense. Fresh air intakes and louver occurring in precast concrete panels shall be installed complete by the heating sub-contractor.

W--REMOVAL AND ALTERATION WORK:

1. This sub-contractor shall be required to remove, install new, alter, cut, and patch existing masonry walls in all locations where existing openings are filled in and where new openings are required. Existing brick and block shall be reused wherever possible.

X--FIRE PROTECTION:

1. The following note appearing on drawing No. 1-A shall be complied with to the extent applicable under this section:
 - a. "All Corridor walls, smoke screens, stairhall walls and fire walls shall be carried up to the underside of roof or floor."
2. The space above openings in masonry walls and partitions as specified above, shall be filled in with block; except the space above opening for smoke screens, which shall be filled in as specified in sub-paragraph 3 below.
3. The space above smoke screens in corridors shall be metal studs with wire lath with plaster on both sides.

Y--GENERAL PROTECTION:

1. Each day just before stopping work the Contractor shall cover the top of unfinished walls with waterproof canvas tarpaulins which shall be properly secured in place, weighted down, and shall overhang not less than 2' 0" on each side. These coverings shall be kept in place at all times except when men are working on the wall.
2. Whenever any concrete or mortar is hoisted at the side of or transported across walls that are to remain exposed, the surface of same shall be protected and covered with waterproof canvas tarpaulins.
3. To minimize rust stains by overhead structural steel, plastic sheeting shall be wrapped over end of structural members and shall be held away from walls with wood cleats as directed by the Architect.

Z--COLD WEATHER PROTECTION:

1. In winter, the sand, brick, water, and other materials shall be kept warm and shall be heated by an approved method so that the work may proceed in an orderly manner. All work shall be properly covered and protected to prevent freezing or other injury. No anti-freeze liquid, salts, or other substances shall be used in the mortar to lower the freezing point.

AA--TEMPORARY HEAT:

1. This sub-contractor shall furnish temporary heat, except as stipulated under statutory weather protection, by providing approved temporary heating units, fuel, power and attendance required to maintain the temperatures above the stipulated minimums during installation of masonry and to prevent newly installed masonry against damage from frost or moisture during its setting period.

2. During the months of November 1 thru March 31 weather protection will be provided by the General Contractor.

BB--CLARIFICATIONS:

1. In addition to aggregates for masonry units as specified in paragraph H--Concrete & Masonry Units, Pumice aggregate with sand added to produce a paint grade block. The average weights of the following sizes of pumice-sand masonry units with standard face shells, as delivered, shall not exceed the amounts indicated below:

4 x 8 x 16 (3 core) 19 lbs
6 x 8 x 16 (3 core) 23 lbs

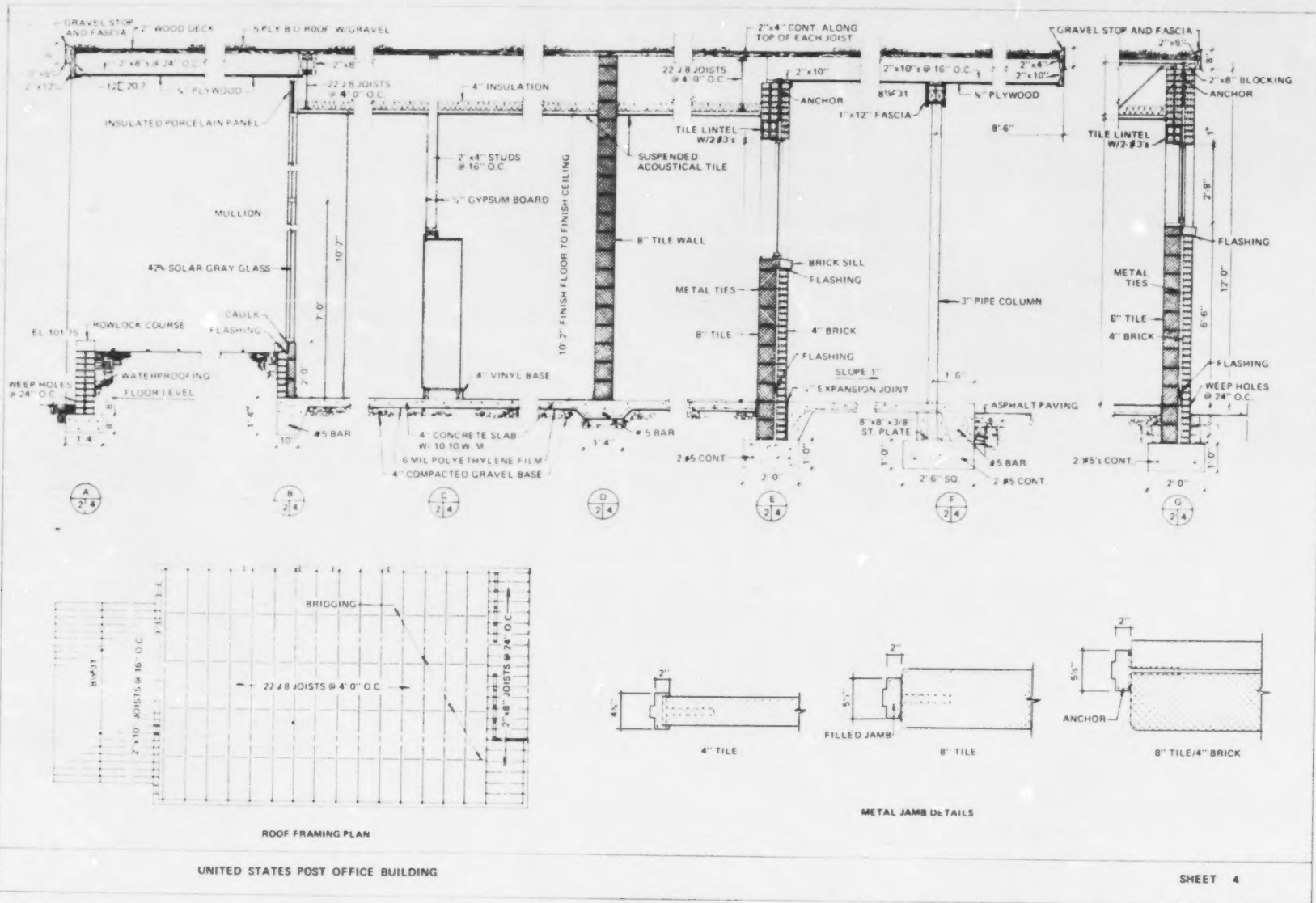
8 x 8 x 16 (2 core) 30 lbs
12 x 8 x 16 (2 core) 40 lbs

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #7--READ A STRUCTURAL PLAN

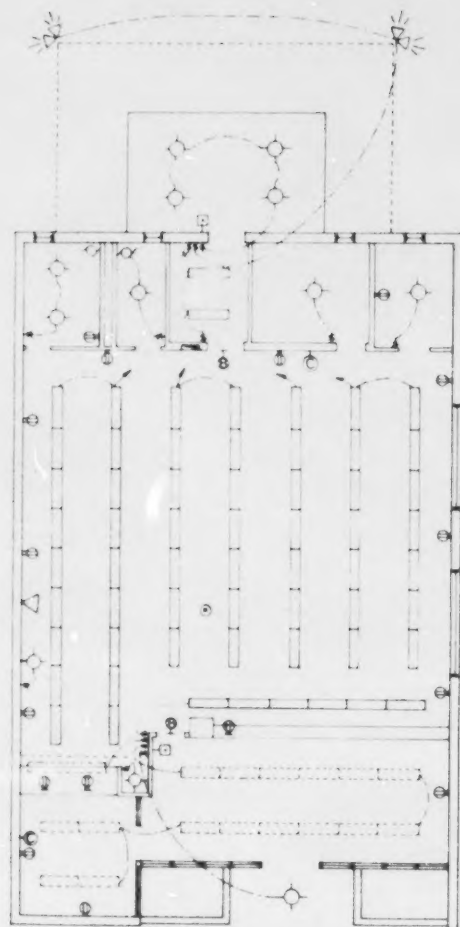
Use Sheets #4 and #5 on the following pages to answer the questions below.

1. How many J8 joists are used in the building?
2. How far apart are the J8 joists?
3. What is the distance from finished floor to J8 joist seat?
4. What are the sizes of the joist for front and back decks?
5. What type of material are the joists for the front and back decks?
6. What size reinforcement bar is called for in the footing?
7. How far apart are weep holes?
8. Where will flashing be installed?
9. What type of lintels are required over windows located in outside walls?
10. What is the size of the fresh air grill on the mechanical unit?

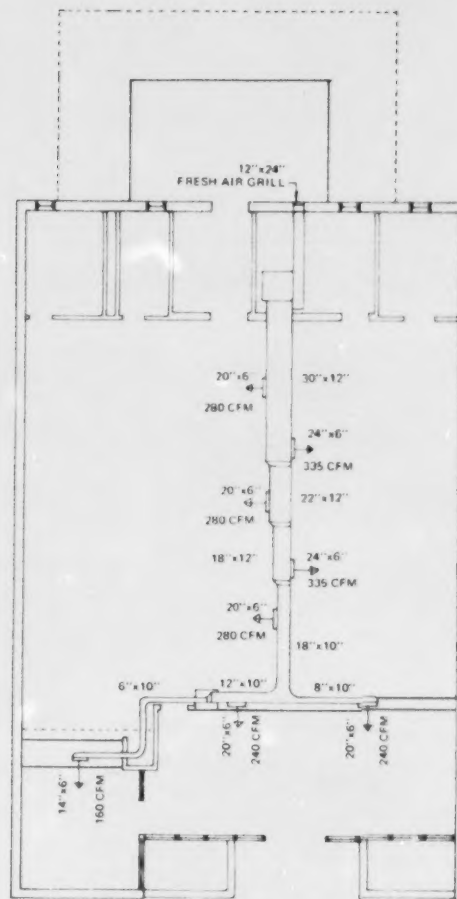


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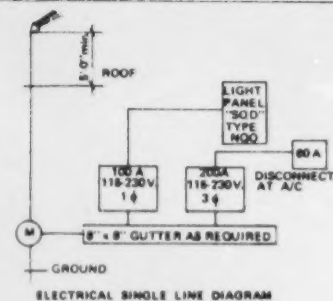
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ELECTRICAL PLAN

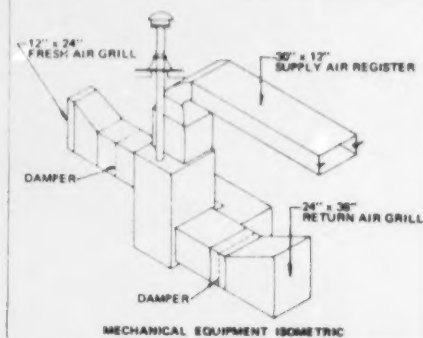


MECHANICAL PLAN



ELECTRICAL SINGLE LINE DIAGRAM

ELECTRICAL LEGEND	
	RECESSED FLUORESCENT FIXTURE
	STEM MOUNTED FLUORESCENT FIXTURE
	INCANDESCENT FIXTURE
	WALL MOUNTED INCANDESCENT FIXTURE
	DUPLEX CONVENIENCE OUTLET
	PUSH BUTTON BELL
	BELL
	FLOOR OUTLET
	CLOCK OUTLET
	MOTOR FAN
	TELEPHONE OUTLET
	SWITCH
	EXTERIOR LIGHT FIXTURE
	PANELBOARD



MECHANICAL EQUIPMENT ISOMETRIC

UNITED STATES POST OFFICE BUILDING

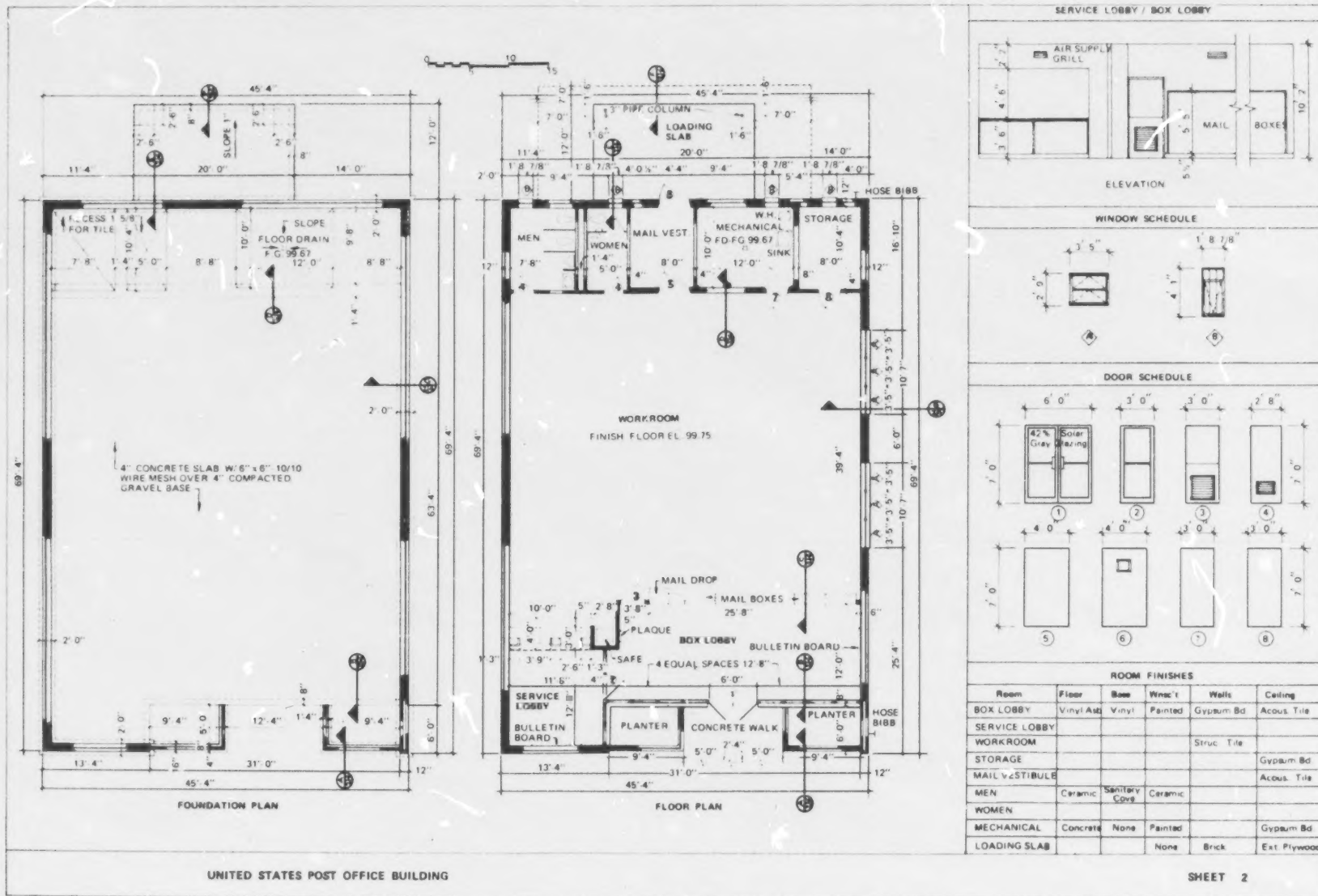
SHEET 5

BASIC BLUEPRINT READING
UNIT II

ASSIGNMENT SHEET #8--READ A PLAN VIEW

Use Sheet #2 on the following page to answer the questions below.

1. What is the length of the building outside measurement?
2. What are the dimensions of the service lobby?
3. What is the thickness of the side walls of the building?
4. What size of doors are used for the entrance?
5. What is the square footage of the rear porch?
6. How much slope is on the slab for the rear porch?



BASIC BLUEPRINT READING UNIT II

ASSIGNMENT SHEET #9--INTERPRET A FINISH SCHEDULE

Using the finish schedule provided, answer the following questions.

ROOM FINISHES					
Room	Floor	Base	Wnsc't	Walls	Ceiling
BOX LOBBY	Vinyl Asb	Vinyl	Painted	Gypsum Bd.	Acous. Tile
SERVICE LOBBY	"	"	"	"	"
WORKROOM	"	"	"	Struc. Tile	"
STORAGE	"	"	"	"	Gypsum Bd.
MAIL VESTIBULE	"	"	"	"	Acous. Tile
MEN	Ceramic	Sanitary Cove	Ceramic	"	"
WOMEN	"	"	"	"	"
MECHANICAL	Concrete	None	Painted	"	Gypsum Bd.
LOADING SLAB	"	"	None	Brick	Ext. Plywood

1. Which rooms require masonry or masonry units for wall finish?
2. Which rooms require masonry units for wainscoat?
3. What area uses brick on the wall?

BASIC BLUEPRINT READING
UNIT II

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

- | | | | |
|----|--------|----|----------|
| 1. | 9/16" | 5. | 2 3/16" |
| 2. | 15/16" | 6. | 2 7/8" |
| 3. | 1 1/4" | 7. | 11 1/16" |
| 4. | 1 7/8" | 8. | 11 9/16" |

Assignment Sheet #2

- | | | | |
|----|--------|----|---------|
| 1. | 3/8" | 5. | 4 1/8" |
| 2. | 7/8" | 6. | 5 1/8" |
| 3. | 1 3/4" | 7. | 5 7/8" |
| 4. | 2 5/8" | 8. | 22 1/8" |

Assignment Sheet #3

- | | | | |
|----|--------|----|--------|
| 1. | 1/2" | 5. | 6" |
| 2. | 1 5/8" | 6. | 8" |
| 3. | 3" | 7. | 9 1/4" |
| 4. | 3 3/4" | 8. | 11" |

Assignment Sheet #4

- | | | | |
|----|--------|----|---------|
| 1. | 1/2" | 5. | 7" |
| 2. | 2" | 6. | 9" |
| 3. | 3 3/4" | 7. | 10 1/2" |
| 4. | 5 1/4" | 8. | 12" |

Assignment Sheet #5

Site plan--Sheet #1

1. 69.33' x 45.33'
2. Next to sidewalk 10' from left front corner

3. 99.75

4. 1.75

Sheet #2

1. 3' 5" x 2' 9" and 4' 1" x 1' 8 7/8"

2. 8

3. a. Men's room

b. Women's room

c. Workroom

d. Storage room

e. Mail vestibule

f. Mechanical room

g. Loading slab

Sheet #3

1. Face

2. All

Assignment Sheet #6

1. a. Machine mixing--Place water for batch in mixer, add half the sand required, add all portland cement, add lime directly from container, add balance of sand. Mix constantly for a minimum period of three minutes in drum-type mixer

b. Hand mixing--Mix dry ingredients in box and cut together at least three times. Add water as needed to obtain proper plasticity

2. a. 1 part portland cement, 2 parts hydrated lime, 7 parts sand (1:2:7)

b. 1 part portland cement, 1 part hydrated lime, 5 parts sand (1:1:5)

3. Discarded

4. Standard

5. a. 19 lbs

b. 21 lbs

- c. 28 lbs
- d. 42 lbs
- 6. 3 brick courses in 8" for new unit
3 brick courses in 7 7/8" to match original
- 7. Limestone

Assignment Sheet #7

- 1. 22
- 2. 4' 0" on center
- 3. 12'
- 4. Front 2" x 8"; back 2" x 10"
- 5. Wood
- 6. #5
- 7. 24" on center
- 8. In outside wall below all windows
- 9. Tile
- 10. 12" x 24"

Assignment Sheet #8

- 1. 69' 4"
- 2. 12' 0" x 11' 8"
- 3. 12"
- 4. 6' 0" x 7' 0"
- 5. 12' x 20' = 240 sq ft
- 6. 1" fall in 12'

Assignment Sheet #9

- 1. a. Workroom
- b. Storage
- c. Mail vestibule

BASIC BLUEPRINT READING

UNIT II

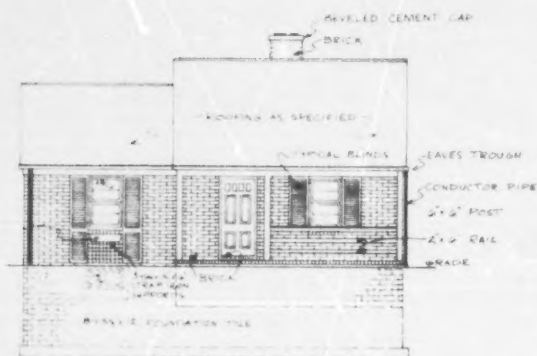
TEST

1. Match the terms on the right to the correct definitions.

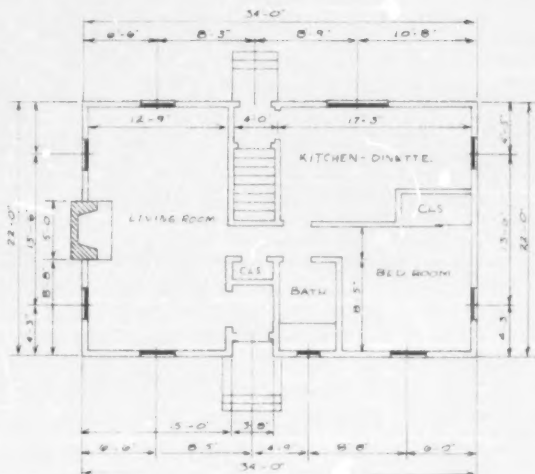
- | | |
|--|--------------------------|
| _____ a. Drawing of an object that has been cut to show internal construction | 1. Alphabet of lines |
| _____ b. Detailed set of written instructions which explains the drawing, describes materials and equipment used in the structure as to quality and type, and becomes part of the contract | 2. Architect's scale |
| _____ c. Arbitrary sign that has been standardized and is used to represent an object, quality, or method | 3. Architectural drawing |
| _____ d. Graphic representation shown with lines and symbols | 4. Blueprint |
| _____ e. Drawing that gives complete detailed information for an element of construction | 5. Detail |
| _____ f. Set of conventional symbols covering all the lines needed to depict an object as to size and shape | 6. Dimensions |
| _____ g. Arrangement of lines and symbols to indicate the actual size for constructing the object that is represented | 7. Elevation |
| _____ h. In architecture, a diagram showing a horizontal view of a structure, such as floor plans and sectional plans | 8. Plan view |
| _____ i. Rule divided into proportional feet and inches; a fraction of an inch is proportionally equal to one foot | 9. Scale drawing |
| _____ j. Drawing representing the front, sides, or rear face of a structure and usually made as though the observer were looking directly at it | 10. Section |
| | 11. Specifications |
| | 12. Symbol |
| | 13. Shop drawing |

- _____ k. Copy of the original detailed drawing
- _____ l. Drawing made to a size either proportionally larger or smaller than the actual size of the object represented
- _____ m. Plans showing detailed information of specific items

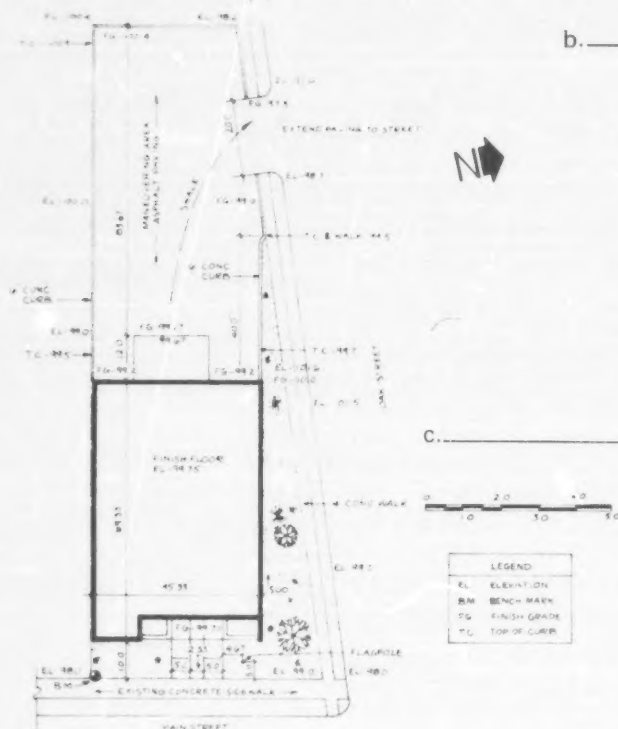
2. Identify the three types of working drawings pictured below.



a. _____



b. _____



c. _____

3. Describe three divisions found in a set of building plans.

4. Identify the types of lines shown below.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____
- h. _____
- i. _____
- UP

5. Identify the following drawing symbols by placing the correct numbers in the blanks.

- | | |
|-----------------------------|--------------------|
| 1. Insulation board, quilt | 10. Plaster |
| 2. Plywood | 11. Cast stone |
| 3. Structural clay tile | 12. Concrete |
| 4. Insulation batts or fill | 13. Wood, finished |
| 5. Slate | 14. Cut stone |
| 6. Brick | 15. Sand |
| 7. Ceramic tile | 16. Wood, rough |
| 8. Marble | 17. Concrete block |
| 9. Steel | 18. Earth |



a. _____



g. _____



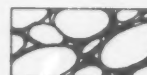
m. _____



b. _____



h. _____



n. _____



c. _____



i. _____



o. _____



d. _____



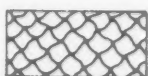
j. _____



p. _____



e. _____



k. _____



q. _____



f. _____



l. _____



r. _____

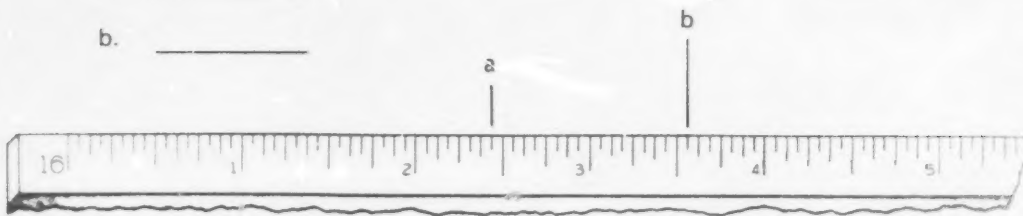
6. Match the abbreviations on the right to the correct names.

- | | |
|------------------------------------|--|
| _____ a. Center to center | 1.  |
| _____ b. Firebrick | 2. EL |
| _____ c. Brick course | 3. C |
| _____ d. Reinforced or reinforcing | 4. X-SECT |
| _____ e. Angle | 5. STN |
| _____ f. Facing tile | 6. AB |
| _____ g. Cast iron pipe | 7. FL |
| _____ h. Weep hole | 8. CS |
| _____ i. Elevation | 9.  |
| _____ j. Modular | 10. CONC B |
| _____ k. Brick | 11. CLKG |
| _____ l. Window | 12. FP |
| _____ m. Cast stone | 13. C to C |
| _____ n. Flashing | 14. WH |
| _____ o. Concrete block | 15. CIP |
| _____ p. Anchor bolt | 16. SECT |
| _____ q. Cross section | 17. FT |
| _____ r. Channel | 18. WDW |
| _____ s. Stone | 19. FBRK |
| _____ t. Caulking | 20. BRK |
| _____ u. Section | 21. MOD |
| _____ v. Fireplace | 22. REINF |

7. Read the measurements on the following scales.

a. _____

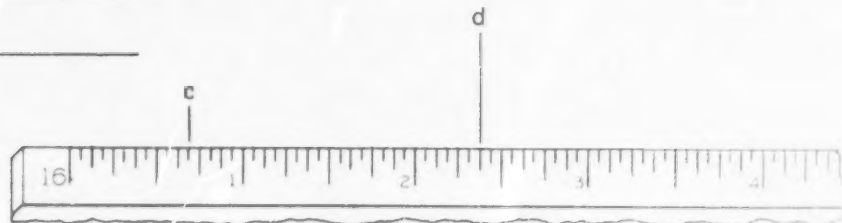
b. _____



Full Scale ($12'' = 12''$)

c. _____

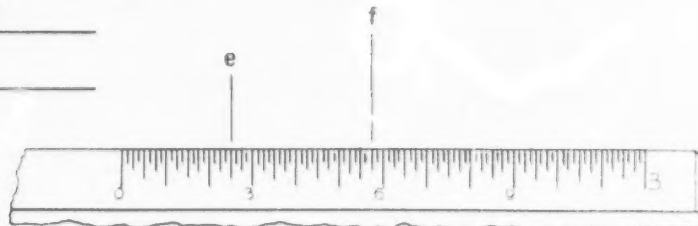
d. _____



Half Scale ($6'' = 12''$)

e. _____

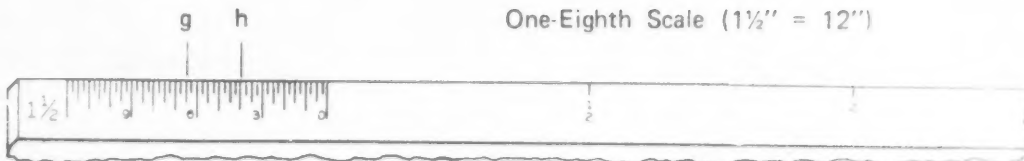
f. _____



One-Fourth Scale ($3'' = 12''$)

g. _____

h. _____



One-Eighth Scale ($1\frac{1}{2}'' = 12''$)

8. Select from the list below items found on a structural drawing by placing an "X" in the blanks.
- _____ a. Heights of finished floors and walls
 - _____ b. Location on site
 - _____ c. Locations of bearing steel
 - _____ d. Anchor bolt locations
 - _____ e. Heights of steel beams, concrete plank, concrete Ts and poured-in-place concrete
 - _____ f. Steel stairs
 - _____ g. Size of bolts and spacing
 - _____ h. Bearing plate locations
 - _____ i. Reinforcing steel drawings and schedules showing spacing and sizes
9. List six major items that may be found in a set of masonry specifications.
- a.
 - b.
 - c.
 - d.
 - e.
 - f.
10. Name six items that may be shown in detail on a drawing.
- a.
 - b.
 - c.
 - d.
 - e.
 - f.

11. Demonstrate the ability to:
 - a. Read the architect's scale.
 - b. Read a blueprint.
 - c. Interpret a set of brick masonry specifications.
 - d. Read a structural plan.
 - e. Read a plan view.
 - f. Interpret a finish schedule.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

BASIC BLUEPRINT READING
UNIT II

ANSWERS TO TEST

1. a. 10 e. 5 i. 2 m. 13
 b. 11 f. 1 j. 7
 c. 12 g. 6 k. 4
 d. 3 h. 8 l. 9
2. a. Elevation
 b. Floor plan
 c. Site plan
3. Description should include:
 - a. Architectural division
 - 1) Site plan
 - 2) Location of building on lot
 - 3) Floor plans
 - 4) Elevations
 - b. Structural division
 - 1) Framing
 - 2) Roof framing
 - 3) Steel work
 - 4) Floor framing
 - c. Mechanical and electrical division
 - 1) Heating
 - 2) Air conditioning
 - 3) Water and sewage
 - 4) Electrical layouts

4.
 - a. Object
 - b. Dimension
 - c. Extension
 - d. Hidden
 - e. Center
 - f. Section
 - g. Break
 - h. Leader
 - i. Stair indicator
5.

a. 3	g. 15, 14, or 10	m. 13
b. 18	h. 14, 15, or 10	n. 8
c. 9	i. 4	o. 17
d. 12	j. 6	p. 16
e. 7	k. 1	q. 11
f. 2	l. 5	r. 10, 14, or 15
6.

a. 13	g. 15	m. 8	s. 5
b. 19	h. 14	n. 7	t. 11
c. 3	i. 2	o. 10	u. 16
d. 22	j. 21	p. 6	v. 12
e. 1	k. 20	q. 4	
f. 17	l. 18	r. 9	
7.

a. 2 7/16"	e. 2 1/2"
b. 3 9/16"	f. 5 3/4"
c. 1 3/8"	g. 6 1/2"
d. 4 3/4"	h. 4"
8. a, c, d, e, f, g, h, i

9. Any six of the following:
- a. Notice to sub-bidders
 - b. General outline of work to be performed
 - c. Mortar materials
 - d. Mortar mixing
 - e. Face brick type, sizes, and allowance per M
 - f. Flue linings
 - g. Back-up brick
 - h. Concrete masonry units
 - i. Concrete block specifications
 - j. Sample panels and coursing information
 - k. Flashing, types of material, and installation
 - l. Masonry layout
 - m. Limestone sills
 - n. Reinforcing in block walls and partitions
 - o. Chimney
 - p. Anchors and wall ties
 - q. Sleeves in masonry walls
 - r. Handling of brick and block
 - s. Control joints
 - t. Cutting and patching
 - u. Pointing and cleaning down
 - v. Setting of ironwork and grilles
 - w. Removal and alteration work
 - x. Fire protection
 - y. General protection
 - z. Cold weather protection
 - aa. Temporary heat
 - bb. Clarifications

10. Any six of the following:
 - a. Flashing
 - b. Weep holes
 - c. Anchor bolts and anchors
 - d. Window and door heights
 - e. Tops of walls
 - f. Floor heights, thickness, and reinforcing
 - g. Types of lintels
 - h. Sill heights and types of sills
 - i. Wood blocking
 - j. Steel beams and joist bearing
 - k. Roof heights
 - l. Gravel stop and fascia
 - m. Expansions joints
 - n. Face of walls
 - o. Back-up
 - p. Metal tie
 - q. Ceiling heights
 - r. Footings and foundations
 - s. Waterproofing
 - t. Polyethylene film
 - u. Compaction
 - v. Sizes of reinforcing steel
 - w. Insulation
 - x. Caulking
11. Performance skills evaluated to the satisfaction of the instructor

MEASURING UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify the basic tools used in measuring and read modular, spacing, and standard measuring rules. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with measuring to the correct definitions.
2. Identify basic measuring tools used by the bricklayer.
3. List uses of modular and spacing rules.
4. Read a standard measuring rule.
5. Describe the procedures for reading modular and spacing rules.
6. Measure objects to the nearest one-sixteenth of an inch when given pictures of objects and a measuring instrument.
7. Draw lines and objects to specified dimensions.
8. Mark course height on a story pole using a modular rule.
9. Mark course height on a story pole using a spacing rule.

MEASURING
UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and assignment sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information and assignment sheets.
- F. Furnish class with story poles and measuring rules for assignment sheets and test.
- G. Evaluate assignment sheets.
- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Complete assignment sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Measuring Tools
 - 2. TM 2--Modular and Spacing Rules
 - 3. TM 3--Graduations on a Rule

4. TM 4--Reading the Eighths Rule
5. TM 5--Reading the Sixteenths Rule
6. TM 6--Reading the Modular Rule
7. TM 7--Reading the Spacing Rule

D. Assignment sheets

1. Assignment Sheet #1--Read a Rule
2. Assignment Sheet #2--Measure Objects
3. Assignment Sheet #3--Draw Lines and Objects
4. Assignment Sheet #4--Read a Modular Rule
5. Assignment Sheet #5--Read a Spacing Rule

E. Answers to assignment sheets

F. Test

G. Answers to test

II. References:

- A. McDonnell, Leo P. *Hand Woodworking Tools*. Albany, New York: Delmar Publishers, 1962.
- B. *Stanley Tool Guide*. New Britain, Connecticut: Educational Dept. of Stanley Tools/Division of Stanley Works, 1972.
- C. Diehl, Donald W., and Penner, Wayman R. *Commercial Carpentry*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1974.

MEASURING
UNIT III

INFORMATION SHEET

I. Terms and definitions

- A. Measuring--Setting of limits or bounds according to a predetermined standard
- B. Inch--Smallest whole unit of linear measure commonly used in masonry
- C. Foot--Unit of measure consisting of twelve equal parts called inches
- D. Fraction--One or more equal parts of a whole
Examples: $1/2$, $1/4$, $3/8$, $5/16$
- E. Rule--Measuring instrument that is graduated in whole units and fractions of units
- F. Dimension--Number of full units and fractions of units between two points
- G. Modular--Unit of measure consisting of nominal dimensions based on four inches

II. Basic measuring tools (Transparency 1)

- A. Modular rule
- B. Steel framing square
- C. Steel tape
- D. Folding rule
- E. Spacing rule

III. Uses of modular and spacing rules (Transparency 2)

- A. Modular rule
 - 1. Determine course height of designated number of courses in 16"
(NOTE: This can only be used for modular measurements.)
 - 2. Mark story pole or corner pole

INFORMATION SHEET

B. Spacing rule

1. Determine number of courses and course height on designated number of course in a given height

(NOTE: This can be used only for nonmodular measurements.)

2. Mark story pole or corner pole

IV. Reading a rule (Transparencies 3, 4, and 5)

(NOTE: All rules read similarly. Some rules are graduated with more divisions per inch than others. Layout tapes are marked sixteen inches on center.)

A. Determine the number of graduations per inch

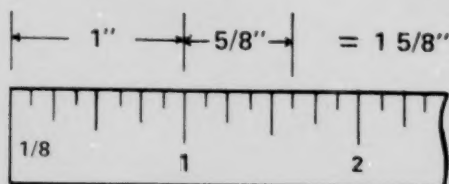
1. Locate small figure at the "0" end of rule which designates the divisions per inch
2. Count the divisions in one inch

(NOTE: Practice to gain skill in determining the divisions.)

B. Determine inches and fractions of an inch

1. Count the graduations in that fraction of an inch beyond the last full inch

Example:



2. Add the fraction to the last full inch

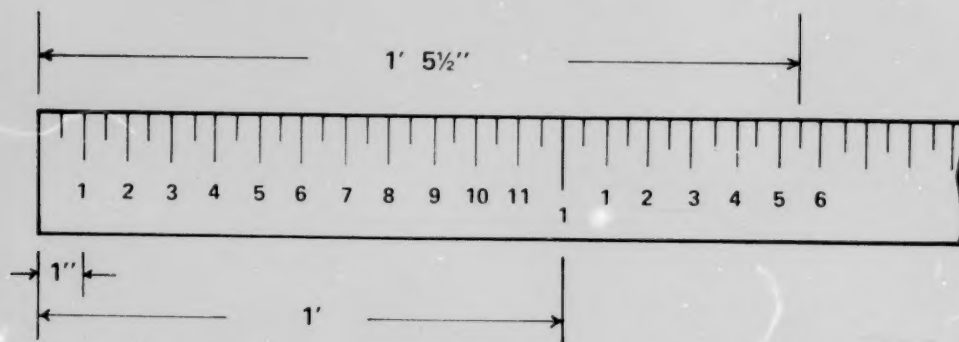
(NOTE: In the above example, the total amount equals one and five-eighths inches.)

C. Reduce the fraction if possible

INFORMATION SHEET

- D. Determine the feet and add the inches and fractions of an inch to obtain a correct measurement

Example:



V. Reading modular and spacing rules (Transparencies 6 and 7)

A. Modular rule

1. Check specifications to determine course height and/or size of brick
2. Determine number of courses in 8" or 16"

Example: 6 courses of standard brick equal 16"

3. Read each reference number

Example: If there are 6 courses in 16", each reference number 6 will be the height of each course

4. Transcribe reference number to standard rule to determine exact course height

Example: The first reference number 6 on the modular rule equals 2 21/32"

(NOTE: Story pole can now be marked using each reference number.)

INFORMATION SHEET

B. Spacing rule

1. Check specifications to determine course height and/or size of brick

Example: Course height is $2 \frac{3}{4}$ "

2. Determine height to be filled

Example: Floor to window sill is 22"; specifications call for 8 courses in 22"

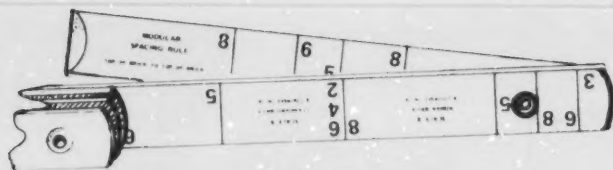
3. Transcribe wall height to spacing rule

Example: $22" = 8$ courses using reference number 6; 1st reference number 6 = $2 \frac{3}{4}$ "

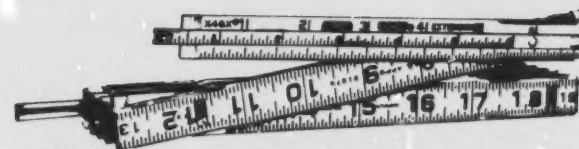
4. Read each reference number to determine course height

(NOTE: Story pole can now be marked using each reference number.)

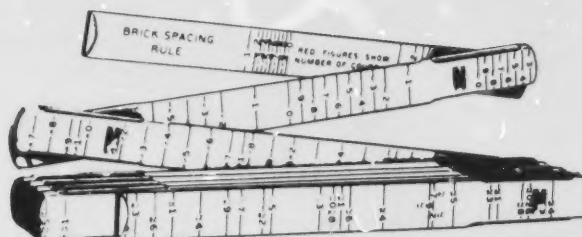
Measuring Tools



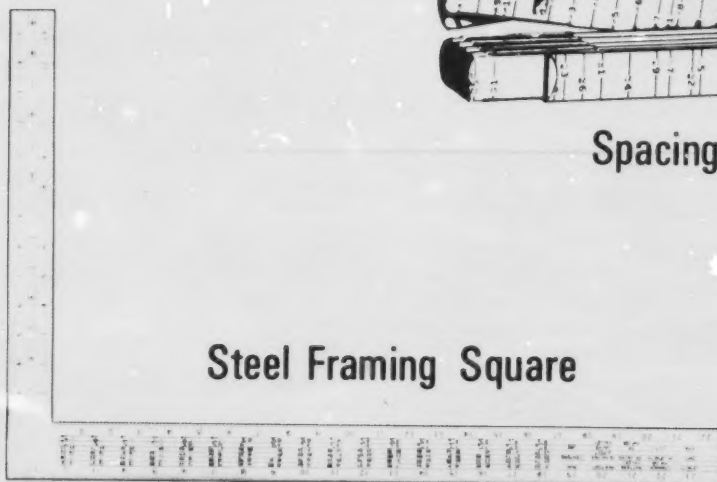
Modular Rule



Folding Rule

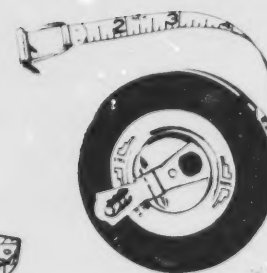
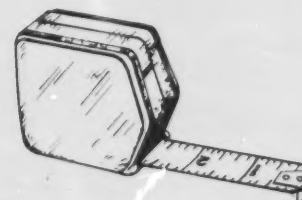


Spacing Rule

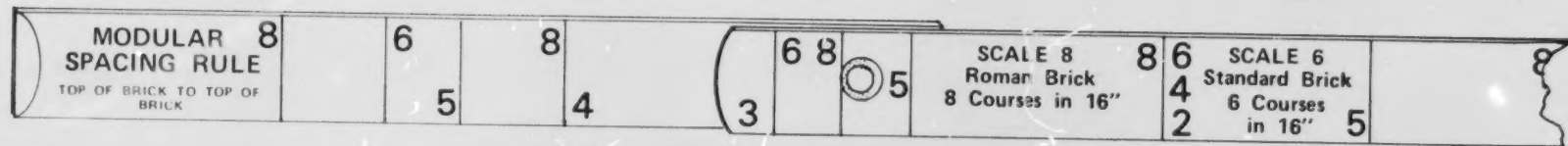


Steel Framing Square

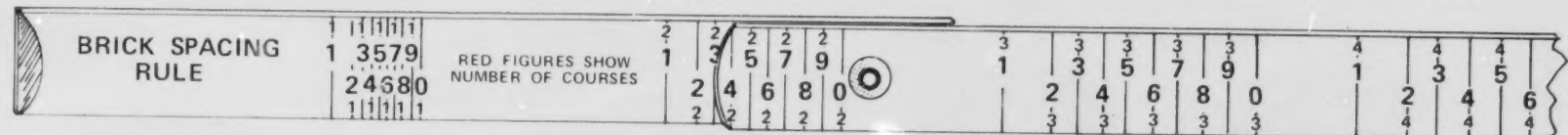
Steel Tapes



Modular and Spacing Rules



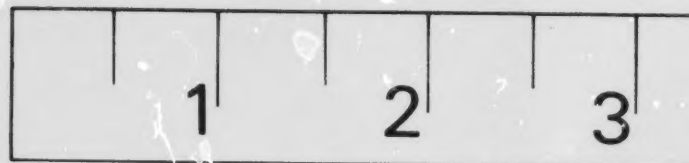
Modular Rule



Spacing Rule

Graduations on a Rule

Halves



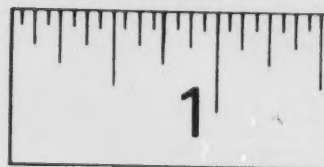
Quarters



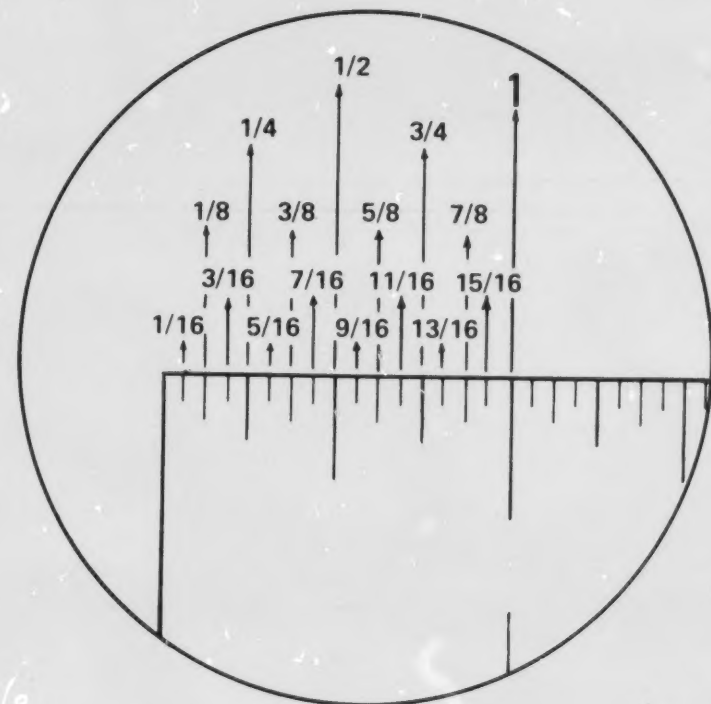
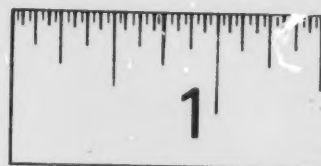
Eighths



Sixteenths

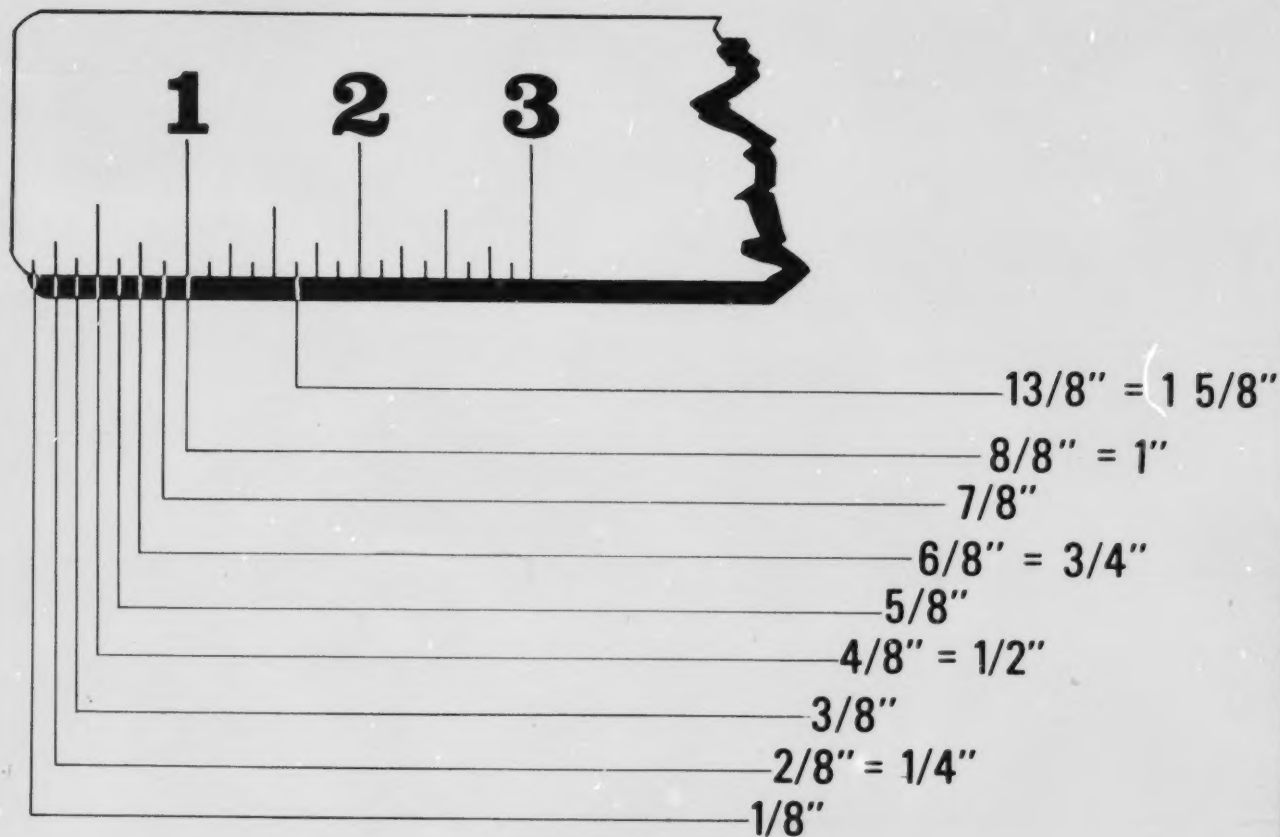


Thirty-Seconds

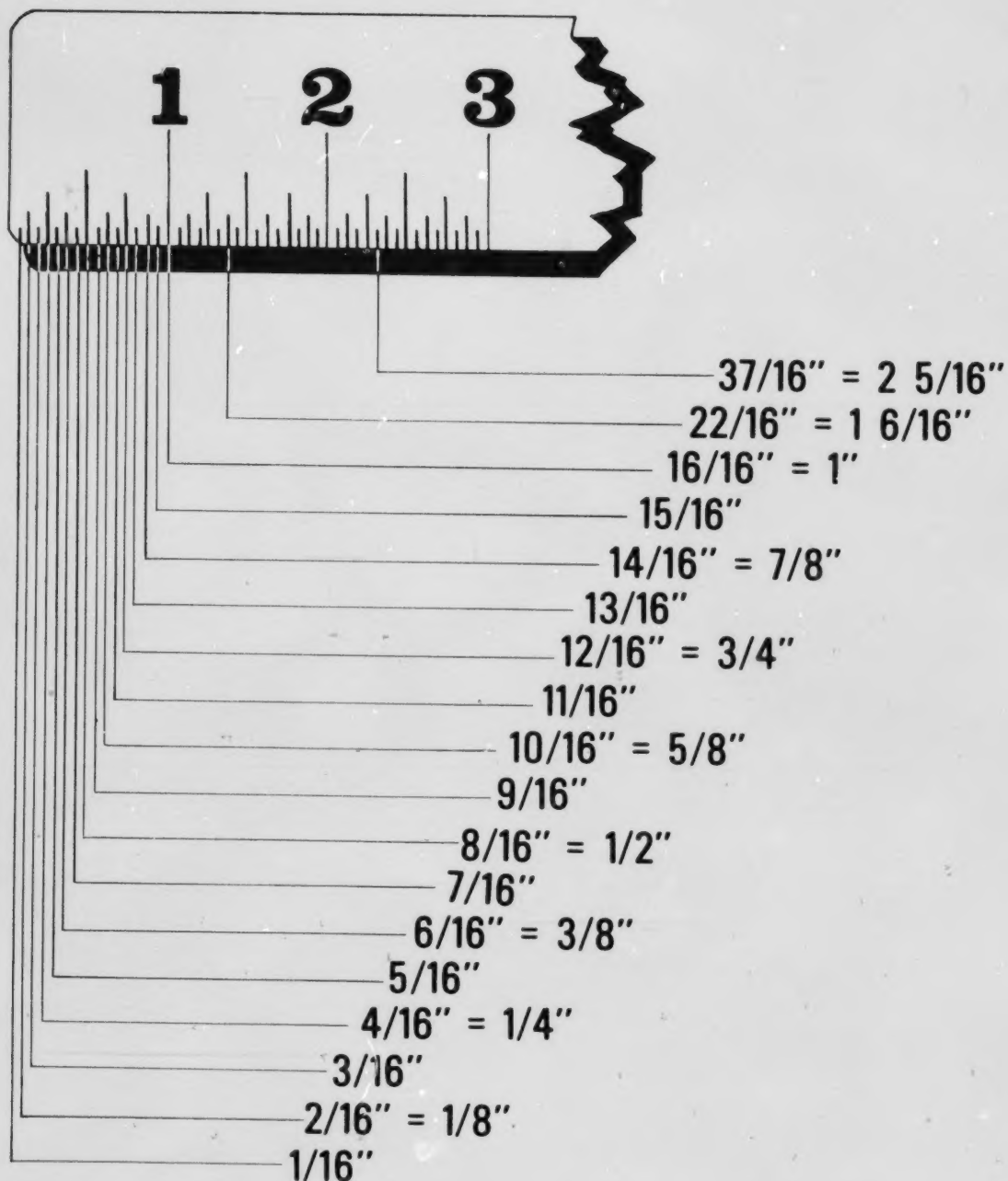


Graduations Applied to a Rule

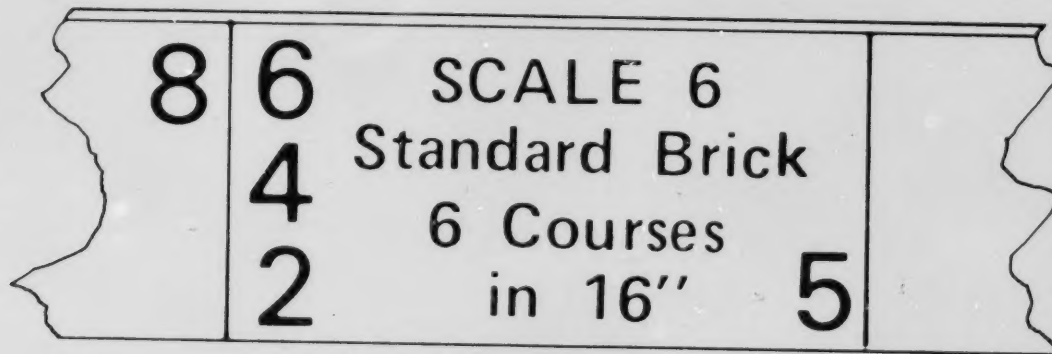
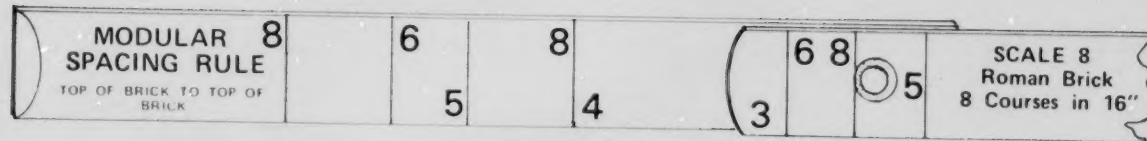
Reading the Eighths Rule



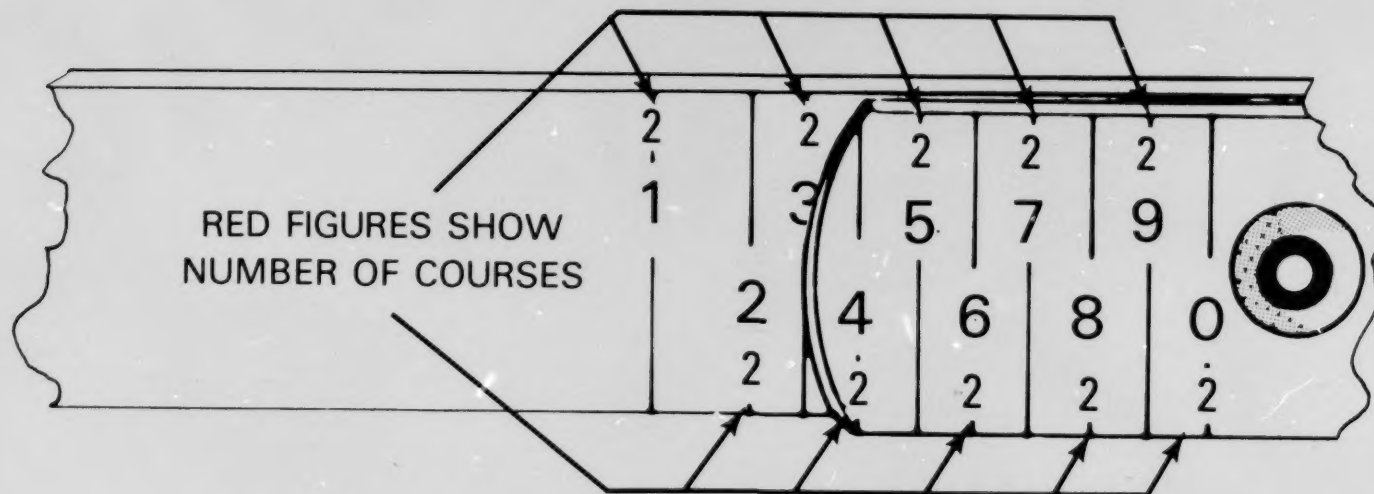
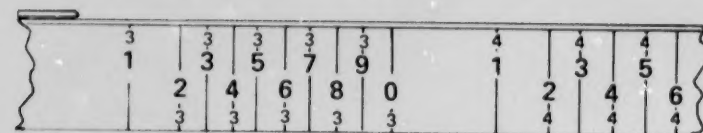
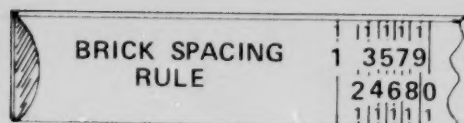
Reading the Sixteenths Rule



Reading the Modular Rule



Reading the Spacing Rule



MEASURING UNIT III

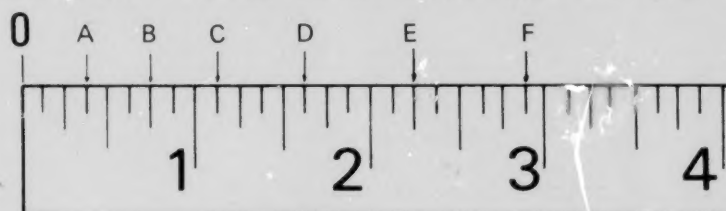
ASSIGNMENT SHEET #1--READ A RULE

1. Use the drawing below and read the rule to the nearest one-fourth inch. Write your answers in the blanks provided.



- a. 0 to A _____
- b. 0 to B _____
- c. 0 to C _____
- d. 0 to D _____
- e. 0 to E _____
- f. 0 to F _____

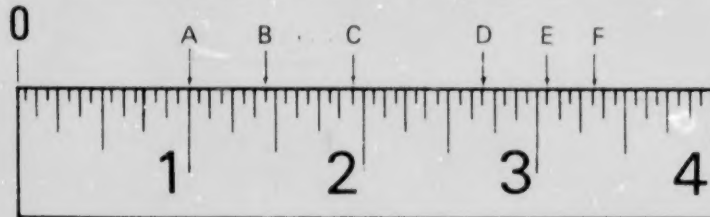
2. Use the drawing below and read the rule to the nearest one-eighth inch.



- a. 0 to A _____
- b. 0 to B _____
- c. 0 to C _____
- d. 0 to D _____
- e. 0 to E _____
- f. 0 to F _____

ASSIGNMENT SHEET #1

3. Use the drawing below and read the rule to the nearest one-sixteenth inch.



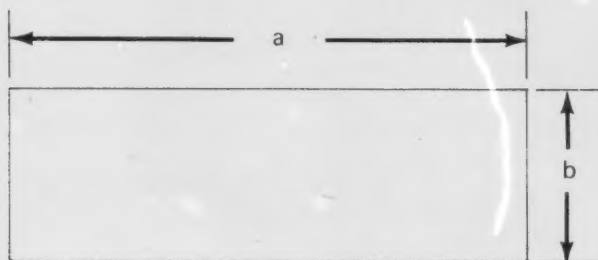
- a. 0 to A _____
- b. 0 to B _____
- c. 0 to C _____
- d. 0 to D _____
- e. 0 to E _____
- f. 0 to F _____

MEASURING
UNIT III

ASSIGNMENT SHEET #2--MEASURE OBJECTS

Using a rule with one-sixteenth inch graduations, measure the following objects.

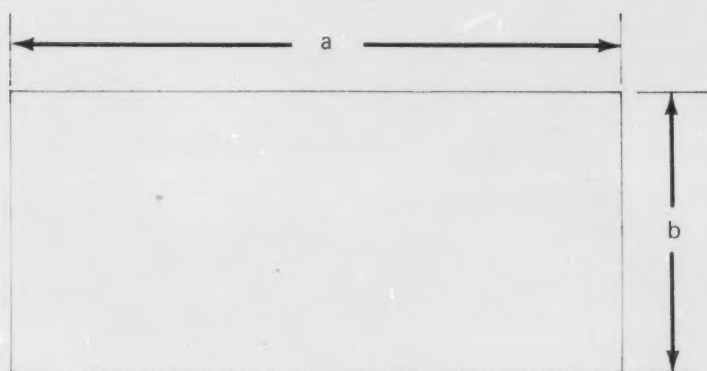
1.



a. Length _____

b. Height _____

2.

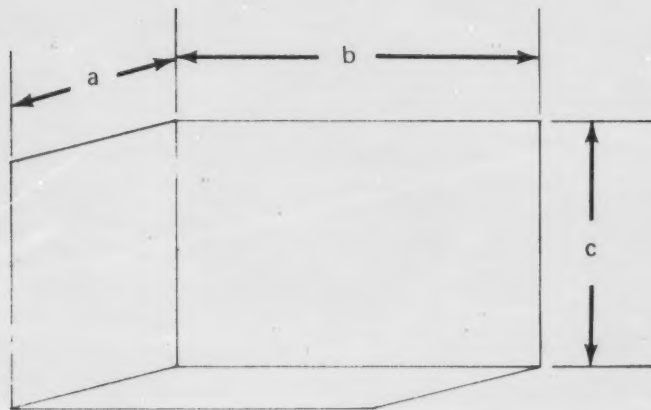


a. Length _____

b. Height _____

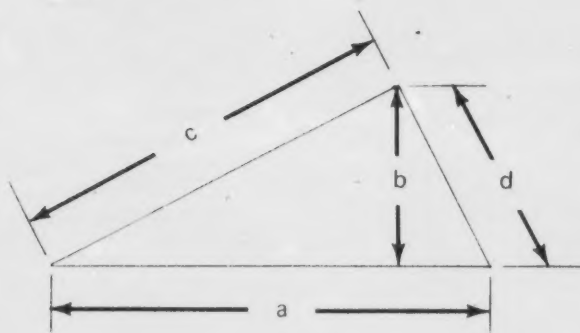
ASSIGNMENT SHEET #2

3.



- a. Width _____
b. Length _____
c. Height _____

4.



- a. Base _____
b. Height _____
c. Slope #1 _____
d. Slope #2 _____

MEASURING
UNIT III

ASSIGNMENT SHEET #3--DRAW LINES AND OBJECTS

Using a rule with one-sixteenth inch graduations, draw the following lines and objects to the given dimensions.

1. Draw straight lines to the following lengths:
 - a. $3 \frac{3}{4}$ inches
 - b. $2 \frac{1}{16}$ inches
 - c. $3 \frac{5}{8}$ inches
 - d. $1 \frac{1}{4}$ inches
 - e. $2 \frac{5}{8}$ inches
2. Draw a rectangle with a height of one and seven-eighths inches and a length of two and three-sixteenths inches.

ASSIGNMENT SHEET #3

3. Draw a triangle with a base length of two and one-half inches, a height of one and one-fourth inches, and one slope of two and one-eighth inches.

MEASURING
UNIT III

ASSIGNMENT SHEET #4--READ A MODULAR RULE

Using a modular rule, determine the layout of a story pole for the following situations. Mark story poles and ask instructor to evaluate them.

1. Specifications call for use of Roman brick. How many courses will be needed to build a wall 54" high? _____
2. Mark a story pole using engineer brick. What is the approximate course height? _____
3. Mark a story pole using standard brick. How many courses of brick will be needed for a wall height of 48"? _____
4. You are asked to build a wall 8 feet 8 inches tall. How many courses of concrete block (8" x 8" x 16") will be needed to complete the wall? _____ Mark a story pole for the wall.

MEASURING
UNIT III

ASSIGNMENT SHEET #5--READ A SPACING RULE

Using a spacing rule, determine the layout of a story pole for the following situations.

1. The plan and specifications call for 16 courses at $2 \frac{11}{16}$ " for 43". Using the spacing rule, what reference number will the story pole be marked? _____

Mark a story pole and turn in for evaluation.

2. The plan and specifications call for 12 courses of brick for $31 \frac{1}{2}$ " high. What reference number should be used for marking the story pole? _____

Mark story pole and turn in for evaluation.

3. You are asked to build a brick wall 33" high with a course height of standard brick.

a. How many courses will be required? _____

b. What reference number or spacing scale should be used to mark story pole?

MEASURING
UNIT III

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

1.
 - a. $\frac{1}{4}$ inch
 - b. $\frac{3}{4}$ inch
 - c. $1 \frac{1}{2}$ inches
 - d. 2 inches
 - e. $2 \frac{1}{2}$ inches
 - f. $3 \frac{1}{4}$ inches
2.
 - a. $\frac{3}{8}$ inch
 - b. $\frac{3}{4}$ inch
 - c. $1 \frac{1}{8}$ inches
 - d. $1 \frac{5}{8}$ inches
 - e. $2 \frac{1}{4}$ inches
 - f. $2 \frac{7}{8}$ inches
3.
 - a. 1 inch
 - b. $1 \frac{7}{16}$ inches
 - c. $1 \frac{15}{16}$ inches
 - d. $2 \frac{11}{16}$ inches
 - e. $3 \frac{1}{16}$ inches
 - f. $3 \frac{5}{16}$ inches

Assignment Sheet #2

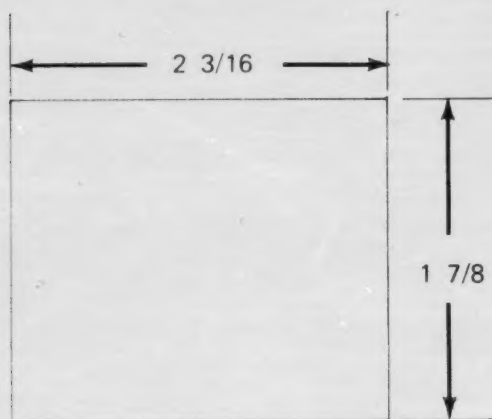
1.
 - a. 3 inches
 - b. 1 inch

2. a. $3 \frac{9}{16}$ inches
b. $1 \frac{5}{8}$ inches
3. a. 1 inch
b. $2 \frac{1}{8}$ inches
c. $1 \frac{7}{16}$ inches
4. a. $2 \frac{9}{16}$ inches
b. $1 \frac{1}{16}$ inches
c. $2 \frac{1}{4}$ inches
d. $1 \frac{3}{16}$ inches

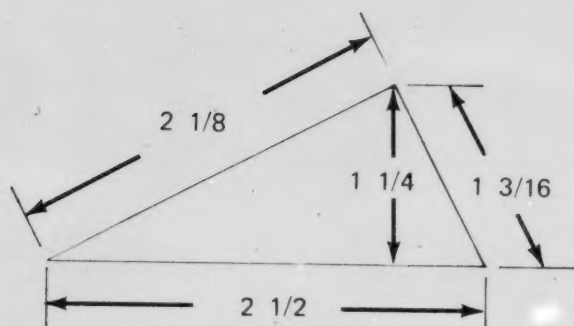
Assignment Sheet #3

1. a. $3 \frac{3}{4}$ inches _____
b. $2 \frac{1}{16}$ inches _____
c. $3 \frac{5}{8}$ inches _____
d. $1 \frac{1}{4}$ inches _____
e. $2 \frac{5}{8}$ inches _____

2.



3.



Assignment Sheet #4

1. 27
2. $3 \frac{3}{16}$ inches
3. 18
4. 13

Assignment Sheet #5

1. #5
2. #4
3. a. 12
b. #6

MEASURING UNIT III

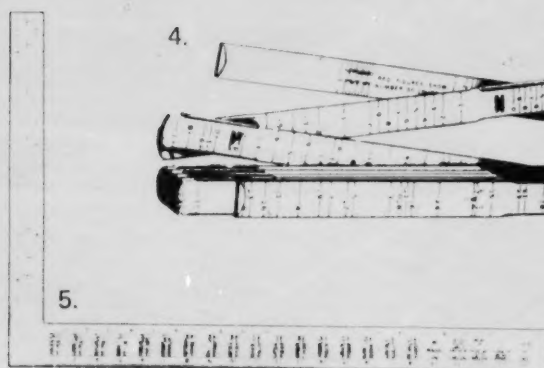
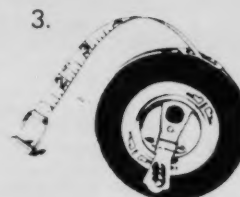
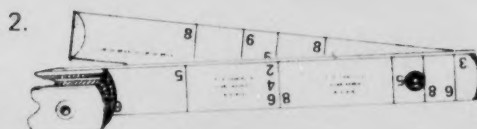
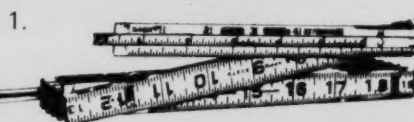
TEST

1. Match the following measuring terms to the correct definitions.

- | | |
|---|--------------|
| _____ a. Setting of limits or bounds according to a predetermined standard | 1. Measuring |
| _____ b. Smallest whole unit of linear measure commonly used in masonry | 2. Rule |
| _____ c. Unit of measure consisting of twelve equal parts called inches | 3. Modular |
| _____ d. One or more equal parts of a whole | 4. Dimension |
| _____ e. Measuring instrument that is graduated in whole units and fractions of units | 5. Inch |
| _____ f. Number of full units and fractions of units between two points | 6. Fraction |
| _____ g. Unit of measure consisting of nominal dimensions based on four inches | 7. Foot |

2. Identify the following measuring tools.

- _____ a. Spacing rule
 _____ b. Steel framing square
 _____ c. Steel tape
 _____ d. Folding rule
 _____ e. Modular rule



3. List uses of modular and spacing rules.

a. Modular rule

1)

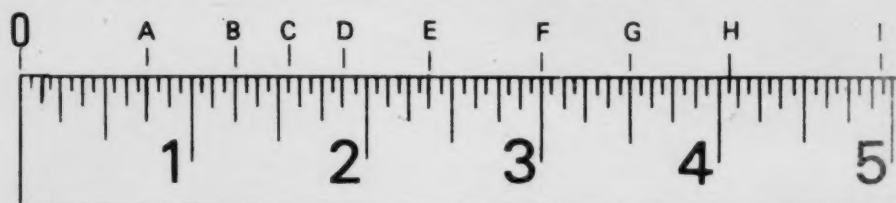
2)

b. Spacing rule

1)

2)

4. Read the rule pictured below to the nearest one-sixteenth of an inch.



___ a. 0 to A

___ b. 0 to B

___ c. 0 to C

___ d. 0 to D

___ e. 0 to E

___ f. 0 to F

___ g. 0 to G

___ h. 0 to H

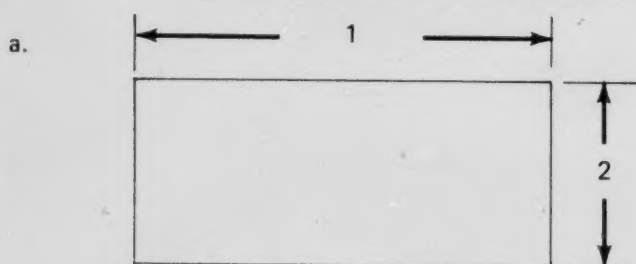
___ i. 0 to I

5. Describe the procedures for reading modular and spacing rules.

a. Modular rule

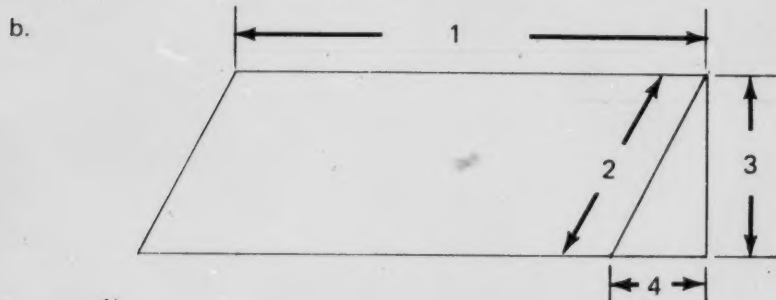
b. Spacing rule

6. Measure the following objects to the nearest one-sixteenth of an inch.



1) _____

2) _____



1) _____

2) _____

3) _____

4) _____

7. Draw objects to the specified dimensions.

- a. Draw a $1 \frac{7}{8}$ inch square.

b. Draw a rectangle $1 \frac{5}{8} \times 2 \frac{1}{4}$ inches.

c. Draw a triangle with a base line of 2 inches, a height of $\frac{7}{8}$ inch, and one slope of $\frac{15}{16}$ inch.

8. Mark course height on a story pole using a modular rule.

9. Mark course height on a story pole using a spacing rule.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when activities 8 and 9 should be completed.)

MEASURING
UNIT III

ANSWERS TO TEST

1.
 - a. 1
 - b. 5
 - c. 7
 - d. 6
 - e. 2
 - f. 4
 - g. 3
2.
 - a. 4
 - b. 5
 - c. 3
 - d. 1
 - e. 2
3.
 - a. Modular rule
 - 1) Determine course height of designated number of courses in 16"
 - 2) Mark story pole or corner pole
 - b. Spacing rule
 - 1) Determine number of courses and course height on designated number of course in a given height
 - 2) Mark story pole or corner pole
4.
 - a. $\frac{3}{4}$ inch
 - b. $1 \frac{1}{4}$ inches
 - c. $1 \frac{9}{16}$ inches
 - d. $1 \frac{7}{8}$ inches
 - e. $2 \frac{3}{8}$ inches
 - f. 3 inches
 - g. $3 \frac{1}{2}$ inches
 - h. $4 \frac{1}{16}$ inches
 - i. $4 \frac{15}{16}$ inches

5. Description should include:

a. Modular rule

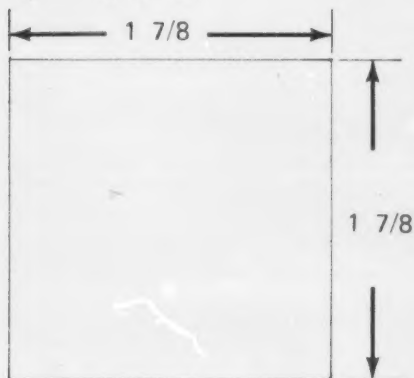
- 1) Check specifications to determine course height and/or size of brick
- 2) Determine number of courses in 8" or 16"
- 3) Read each reference number
- 4) Transcribe reference number to standard rule to determine exact course height

b. Spacing rule

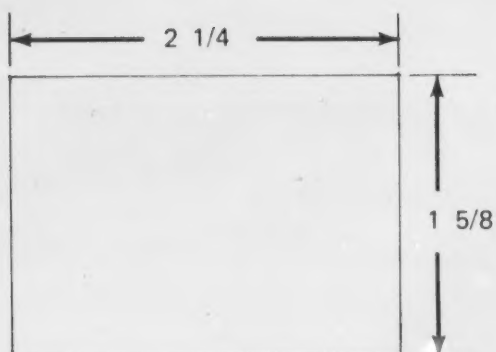
- 1) Check specifications to determine course height and/or size of brick
- 2) Determine height to be filled
- 3) Transcribe wall height to spacing rule
- 4) Read each reference number to determine course height

6. a. 1) $2 \frac{7}{16}$ inches2) $1 \frac{1}{16}$ inchesb. 1) $2 \frac{3}{4}$ inches2) $1 \frac{3}{16}$ inches3) $1 \frac{1}{16}$ inches4) $\frac{9}{16}$ inch

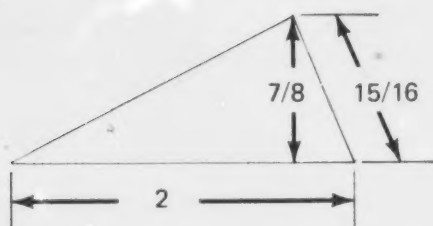
7. a.



b.



c.



8. Evaluated to the satisfaction of the instructor
9. Evaluated to the satisfaction of the instructor

BUILDER'S LEVEL UNIT IV

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify the different types of levels and parts of the builder's level. The student should demonstrate the ability to set up and adjust the builder's level and read the rod. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with the builder's level to the correct definitions.
2. Identify the different types of levels.
3. Name the types of self-reading rods.
4. Identify the parts of the builder's level.
5. Distinguish between the vertical cross hair and the horizontal cross hair on the builder's level.
6. Identify the parts of the leveling rod.
7. Name the common errors that contribute to incorrect measurement.
8. List rules to follow in providing care of the level.
9. Identify hand motions used by the instrument man to guide the target man.
10. Read the self-reading rod.
11. Demonstrate the ability to set up and adjust the builder's level.

BUILDER'S LEVEL
UNIT IV

SUGGESTED ACTIVITIES

- I. Instructor:
 - A. Provide student with objective sheet.
 - B. Provide student with information, assignment, and job sheets.
 - C. Make transparencies.
 - D. Discuss terminal and specific objectives.
 - E. Discuss information and assignment sheets.
 - F. Demonstrate and discuss procedures outlined in the job sheet.
 - G. Invite local surveyor or professional instrument man to come and demonstrate use of builder's level.
 - H. Assign student a leveling job.
 - I. Give test.
- II. Student:
 - A. Read objective sheet.
 - B. Study information sheet.
 - C. Complete assignment sheet.
 - D. Demonstrate the ability to accomplish the procedure outlined in the job sheet.
 - E. Take test.

INSTRUCTIONAL MATERIALS

- I. Included in this unit:
 - A. Objective sheet
 - B. Information sheet

C. Transparency masters

1. TM 1--Types of Levels
2. TM 2--Self-Reading Rods
3. TM 3--Parts of the Builder's Level
4. TM 4--Parts of the Leveling Rod
5. TM 5--Hand Motions
6. TM 6--Reading the Rod

D. Assignment Sheet #1--Read the Self-Reading Rod

E. Answers to assignment sheet

F. Job Sheet #1--Set Up and Adjust the Builder's Level

G. Test

H. Answers to test

II. References:

- A. Schwab, Glenn O.; Frevert, Richard L.; Barnes, Kenneth K.; and Edminster, Talcott W. *Elementary Soil and Water Engineering*. New York: John Wiley and Sons, Inc., 1967.
- B. Phipps, Lloyd J.; McColly, H. F.; Scranton, L. L.; and Cook, G. C. *Farm Mechanics Text and Handbook*. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1964.
- C. *Setting Up the Instrument: A Color Filmstrip and Manual*. San Luis Obispo: California State Polytechnic College.
- D. *Reading the Rod: A Color Filmstrip and Manual*. San Luis Obispo: California State Polytechnic College.

BUILDER'S LEVEL
UNIT IV

INFORMATION SHEET

I. Terms and definitions

- A. Bench mark (BM)--Permanent point of known or assumed elevation

(NOTE: Specific point on curb or culvert is sometimes used.)

- B. Temporary bench mark (TBM)--Elevation reference point

- C. Fall--Pertaining to the slope of a line, such as inches of fall per foot of run

Example: 1" fall per 1' of run

- D. Grade line--Proposed or future level of ground at construction line

- E. Height of instrument (HI)--Elevation of the level line of sight or of the cross hairs in the telescope with respect to the bench mark (height of instrument above or below bench mark)

- F. Grade stake--Stake driven into the ground locating the proposed grade

(NOTE: Read from the bench mark.)

- G. Site--Plot of ground on which a project is to be constructed

- H. Line of sight--Level line through the instrument as viewed by the eye

(NOTE: The place where the vertical hair crosses the horizontal hair is called the "line of sight.")

- I. Self-reading rod--Scale on rod adjusted to height of instrument elevation and direct surface elevation read by instrument man

- J. Differential leveling--Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark

- K. Level rod--Rod used in leveling; normally graduated in tenths and hundredths of a foot

- L. Finished floor height--Elevation of finished floor in relation to bench mark

- M. Four foot masonry reference mark--Reference mark used by bricklayer to indicate 4' intervals above bench mark

INFORMATION SHEET

II. Types of levels (Transparency 1)

- A. Engineer's dumpy
- B. Engineer's wild tilting
- C. Turret
- D. Engineer's zeiss
- E. Builder's

(NOTE: The builder's level is the most practical and economical for general use and is sufficiently accurate for most purposes.)

III. Types of self-reading rods (Transparency 2)

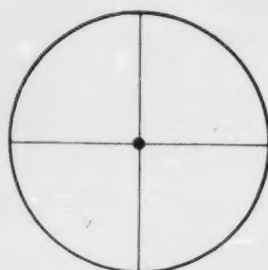
- A. Philadelphia or "Philly" rod
- B. Elevation or "Linker" rod

IV. Parts of the builder's level (Transparency 3)

- A. Eyepiece
- B. Telescope barrel
- C. Focusing screw
- D. Sun shade
- E. Bubble tube
- F. Leveling head
- G. Leveling screw
- H. Head plate
- I. Tripod
- J. Leg thumb nut
- K. Slow motion screw
- L. Clamp

INFORMATION SHEET

V. Cross hairs



- A. Vertical--Indicates direction
- B. Horizontal--Indicates flat plane
- C. Cross of the two--Designates point on "line of sight;" intersection of cross hairs and the optical center of objective lens

VI. Parts of the leveling rod (Transparency 4)

- A. Target face

(NOTE: The red and white disc on the rod is used for certain types of readings.)

- B. Target clamp

(NOTE: The clamp holds the target in place.)

- C. Rod clamp

(NOTE: This holds the rod when extended.)

- D. Vernier scale

(NOTE: It is found on the target face and rod clamp and enables reading to the nearest thousandth of a foot.)

VII. Common errors in measurement

- A. Tape not pulled tight enough
- B. Tape not in proper alignment

INFORMATION SHEET

- C. Plumb bob not used when measuring on slope

(NOTE: The plumb bob is used to maintain horizontal measurement.)

- D. Reading or recording the wrong numbers (human errors)

VIII. Care of the level

(CAUTION: Do not set up instrument in shade and move to hot sun without releasing leveling screws.)

- A. Protect against shock and vibration during transport
- B. Keep in box except when in use
- C. Place lens and tripod cap in box after removing from instrument
- D. Attach instrument onto tripod carefully and firmly before moving tripod
(NOTE: Never force screws or other moving parts of an instrument.)
- E. Use sunshade regardless of the weather
- F. Clean lenses with soft tissue

(CAUTION: Do not clean with fingers or rough cloth. Do not remove lenses.)

- G. Loosen set screws when not in use

IX. Hand motions (Transparency 5)

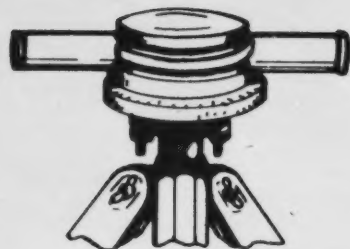
X. Reading the rod (Transparency 6)

A. Graduations

1. Feet
2. Tenths of feet
3. Hundredths of feet
4. Thousandths of feet

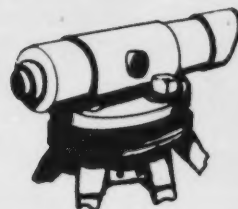
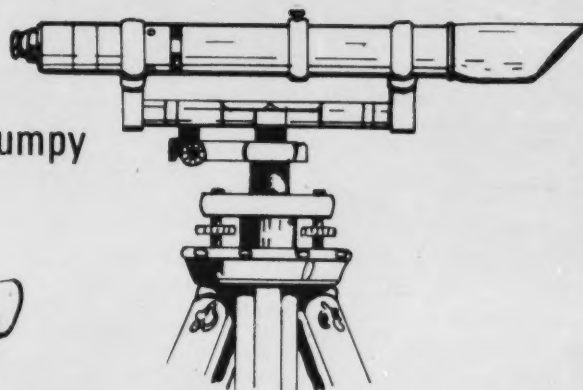
- B. Red numbers designate feet
- C. Black numbers indicate tenths of feet
- D. Black and white marks show hundredths of feet
- E. Vernier scale reads thousandths of feet

Types of Levels

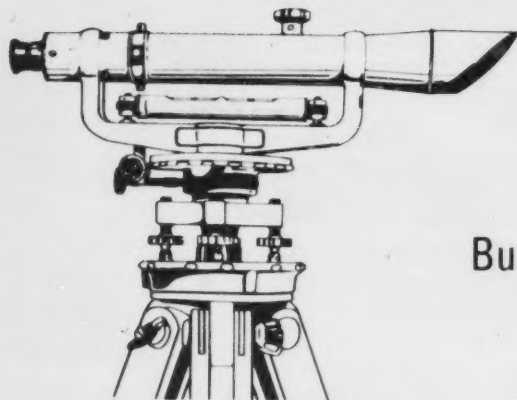


Turret

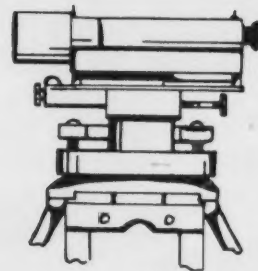
Engineer's Dumpy



Engineer's Zeiss



Builder's



Engineer's Wild Tilting

Self-Reading Rods

Positive
↑
Reading

Philadelphia
or
"Philly" Rod

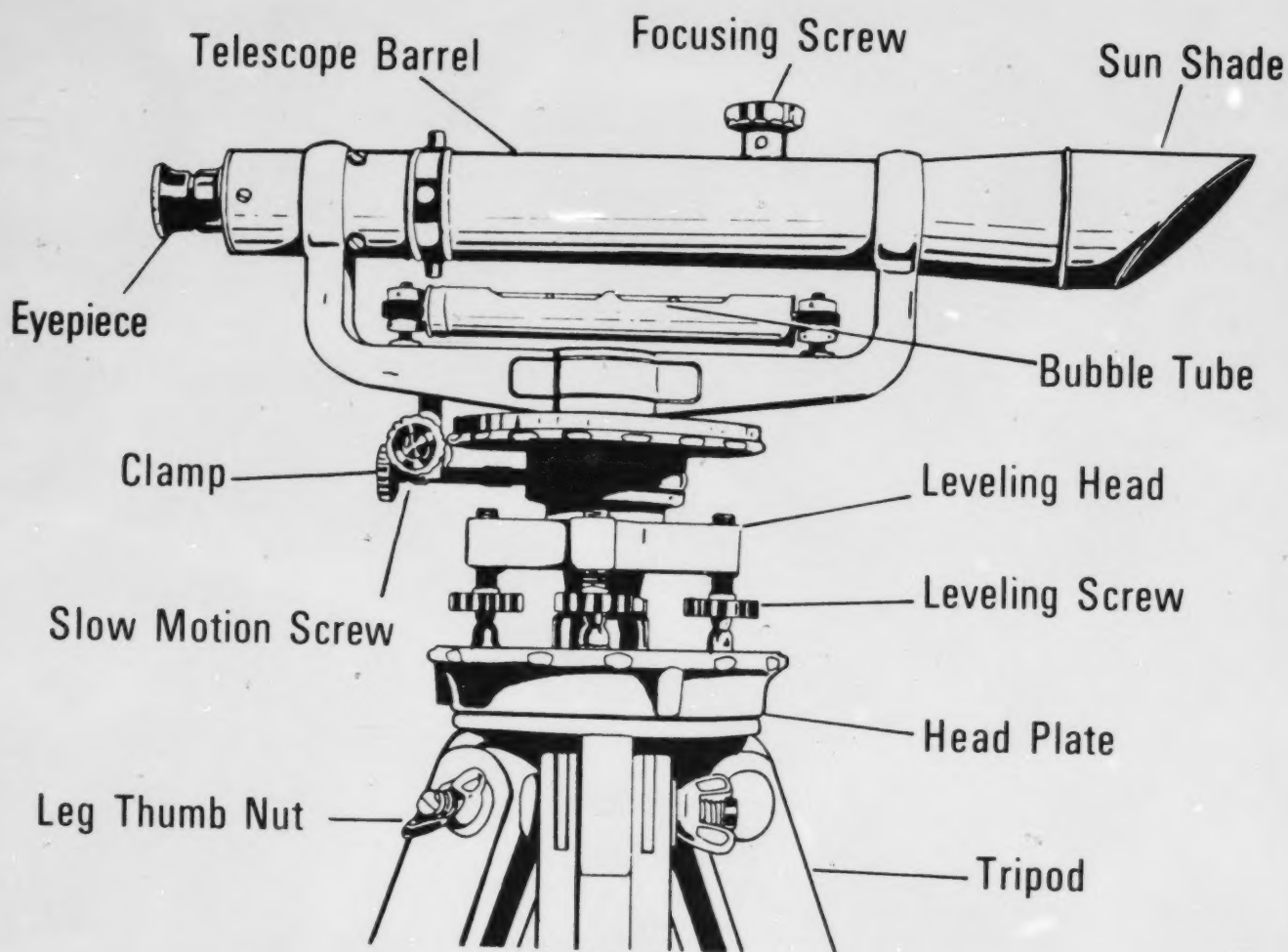


Direct
↓
Reading

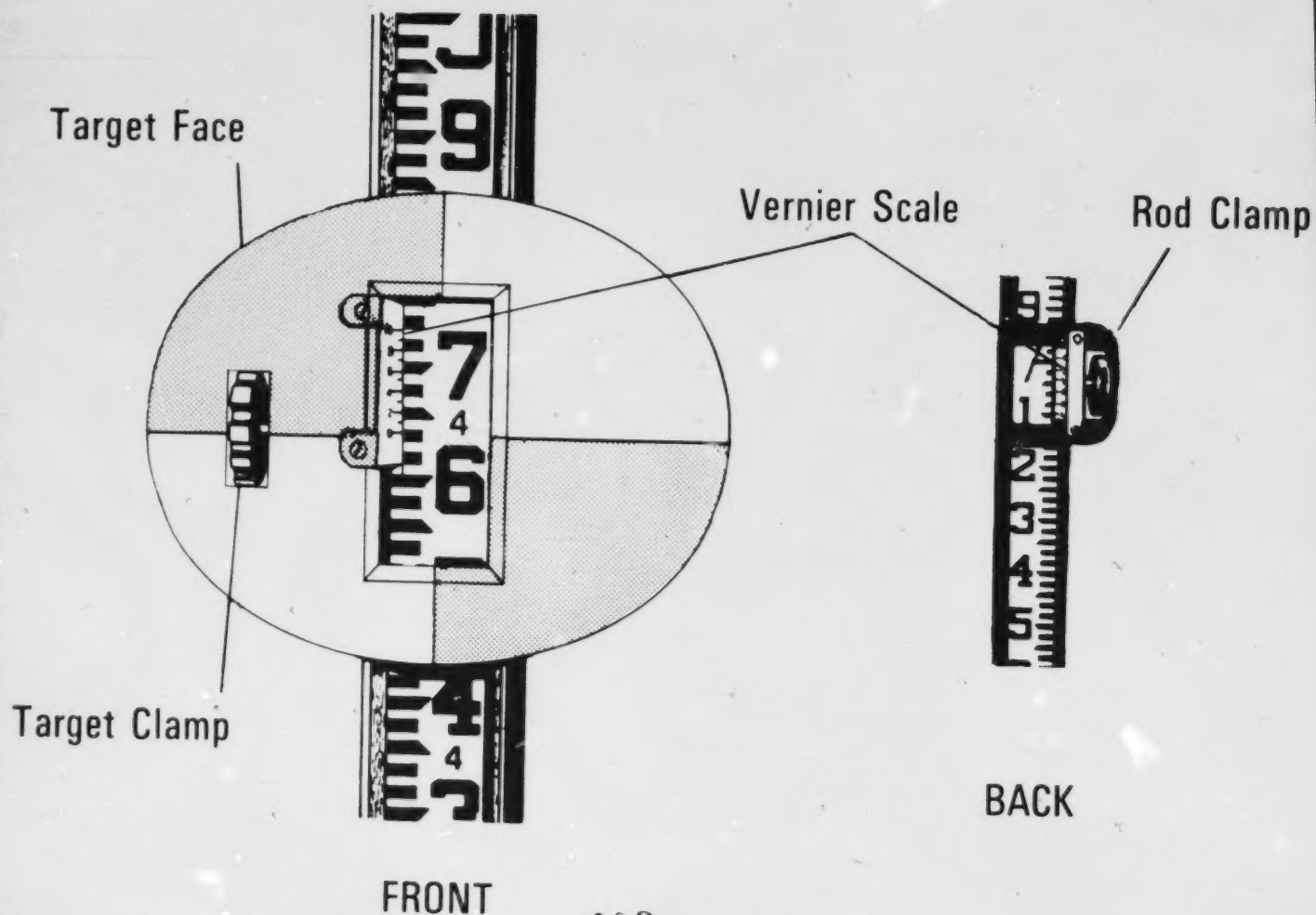
Elevation
or
"Linker" Rod



Parts of the Builder's Level



Parts of the Leveling Rod



Hand Motions



Move in this
Direction



Move in this
Direction



Move Up



Move Down



Turning Point



Observation Completed
or Move On
or Understood



Come In



Step
Away
from
Inst.



Walk
in
Tight
Circle

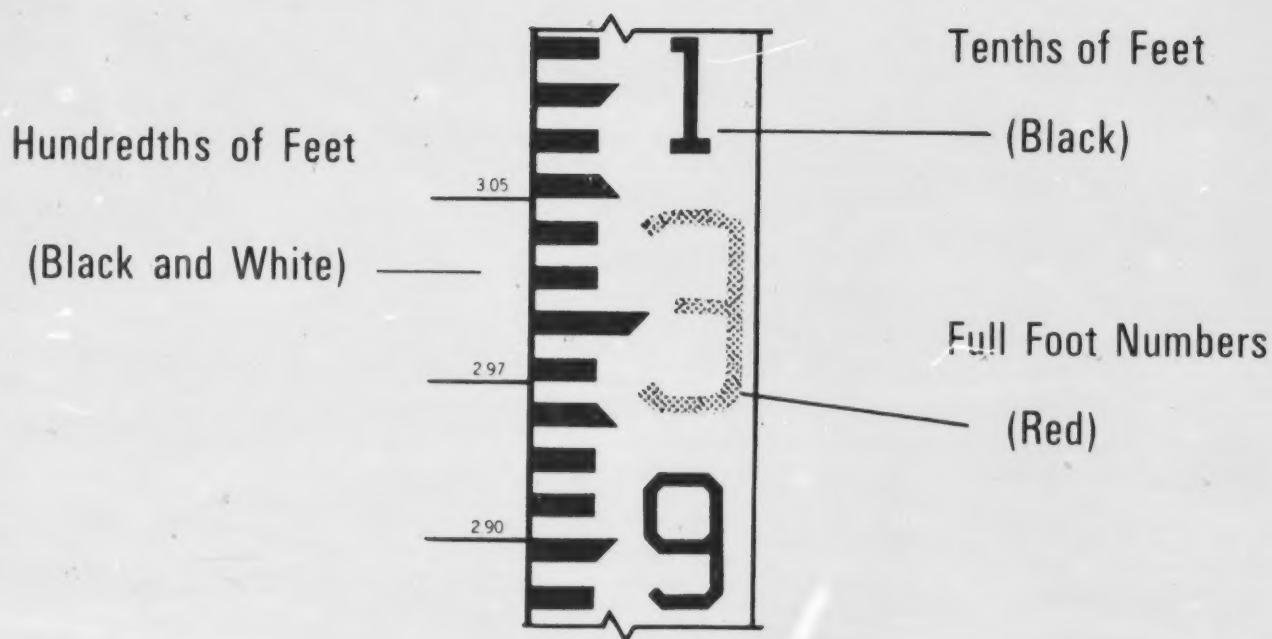


Wave Rod from
Side to Side

Wrong Face
or Check Clamp
or Rod Upside Down

Use
Long Rod

Reading the Rod

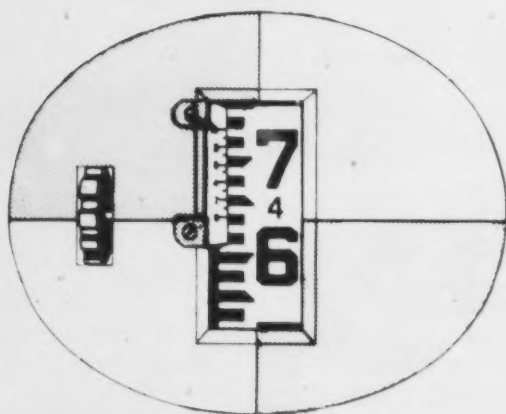


NOTE: Vernier scale reads thousandths of feet

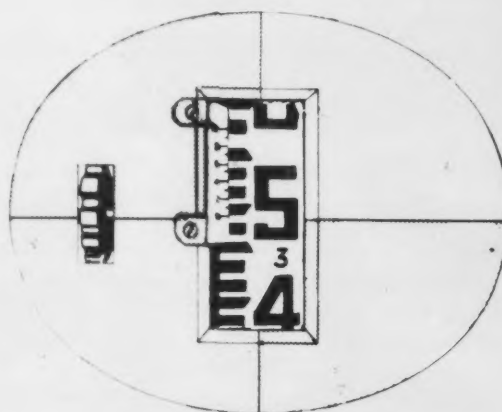
BUILDER'S LEVEL UNIT IV

ASSIGNMENT SHEET #1--READ THE SELF-READING ROD

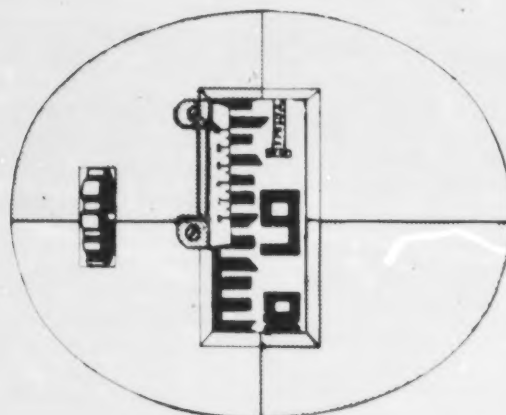
Read each of the illustrations below to the nearest hundredth. Record your results in the blanks provided.



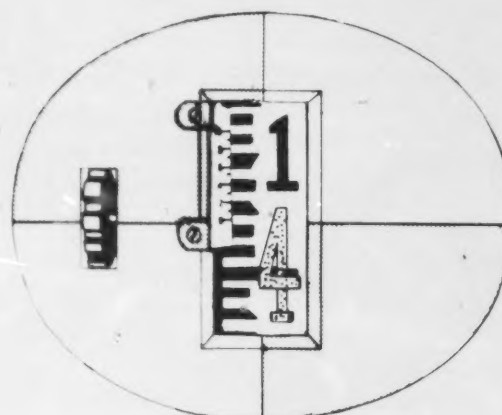
a. _____



b. _____



c. _____



d. _____

BUILDER'S LEVEL
UNIT IV

ANSWERS TO ASSIGNMENT SHEET

- a. 4.64
- b. 3.48
- c. .90
- d. 4.05

BUILDER'S LEVEL UNIT IV

JOB SHEET #1--SET UP AND ADJUST THE BUILDER'S LEVEL

- I. Tools and equipment
 - A. Instrument
 - B. Tripod
- II. Procedure
 - A. Grasp the two legs of the tripod that are nearest you and set the leg shoes in the ground about three feet apart (Figure 1)

FIGURE 1



- B. Swing third leg out to form a triangle
(NOTE: If the ground is not level, you may have to change position of tripod in order to keep head plate level. Always place two legs on downhill or unlevel side.)
- C. Tighten leg thumb nuts
- D. Check head plate to see if it is level (Figure 2)

FIGURE 2



JOB SHEET #1

- E. Remove instrument from carrying case by lifting the level bar (Figure 3)

(CAUTION: Never grasp the telescope barrel while removing instrument from carrying case.)

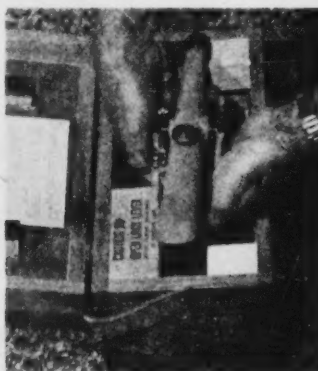


FIGURE 3

- F. Attach instrument to head plate by screwing it down (Figure 4)

(CAUTION: Keep a firm grip on instrument until it is securely in position on tripod.)

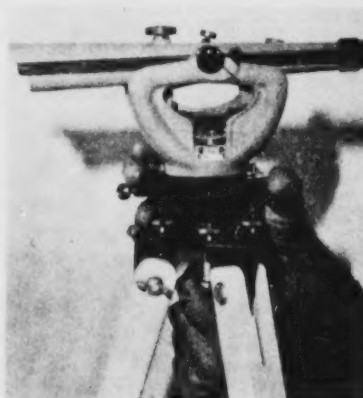


FIGURE 4

- G. Remove dust cap from front lens

(NOTE: The dust cap should be kept in place in order to protect the lens from dust or scratches.)

- H. Attach sun shade to the instrument

JOB SHEET #1

- I. Align telescope barrel directly over one pair of leveling screws (Figure 5)

(NOTE: The leveling screws will be used just as the name indicates, to level the instrument.)

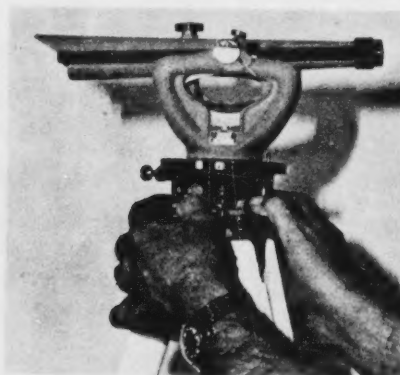


FIGURE 5

- J. Rotate screws under the leveling head to bring bubble to the center of the leveling tube (Figure 6)

(NOTE: Move your thumbs in opposite directions.)

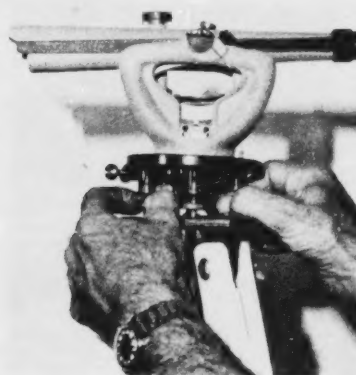


FIGURE 6

- K. Check bubble to see if it is centered

JOB SHEET #1

- L. Turn instrument clockwise through 90 degrees to align with the other pair of leveling screws (Figure 7)

FIGURE 7



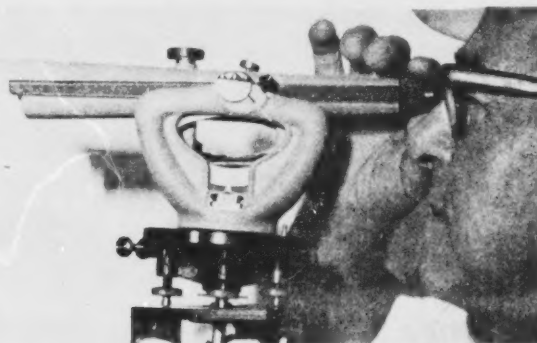
- M. Bring bubble to center of marks by rotating leveling screws
- N. Turn instrument clockwise through 90 degrees to bring it parallel with first pair of leveling screws
- O. Center bubble again
- P. Turn instrument clockwise through 90 degrees to bring it parallel with second pair of leveling screws
- Q. Center bubble again

(NOTE: Bubble should stay in center regardless of what direction the telescope is pointing. If bubble does not, instrument is out of level and should be adjusted by competent personnel.)

- R. Focus cross hairs so that they appear sharp and clear (Figure 8)

(NOTE: Focusing is accomplished by looking through the eyepiece and by turning the eyepiece ring until the cross hairs become sharp or "clear." Focus into infinity to bring cross hairs into adjustment.)

FIGURE 8



JOB SHEET #1

- S. Be sure cross hairs are focused

(NOTE: The target may not be in focus.)

- T. Rotate the focusing screw to bring target into sharp focus (Figure 9)



FIGURE 9

(NOTE: When cross hairs and target are in sharp focus, you should be able to read a rod accurately. Always tie level shots back to starting bench mark to check for error in rod shots or in field notes.)

(CAUTION: After instrument is level, keep hands off tripod. Use the instrument only. If instrument creeps off level or is bumped, stop, reset tripod, relevel instrument, and start again from last known good bench mark.)

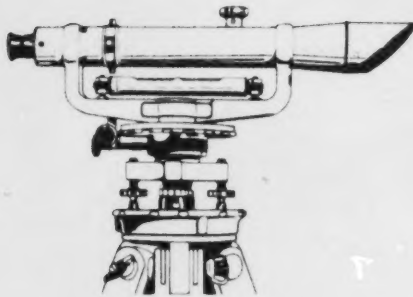
BUILDER'S LEVEL UNIT IV

TEST

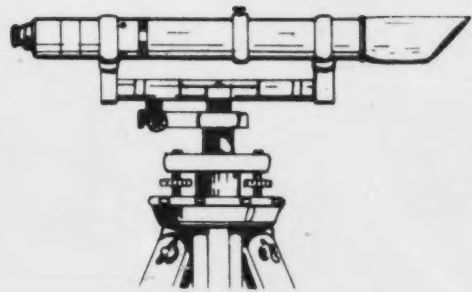
1. Match the terms on the right to the correct definitions.

- | | |
|---|--------------------------------------|
| _____ a. Rod used in leveling; normally graduated in tenths and hundredths of a foot | 1. Bench mark (BM) |
| _____ b. Plot of ground on which a project is to be constructed | 2. Site |
| _____ c. Pertaining to the slope of a line, such as inches of fall per foot of run | 3. Line of sight |
| _____ d. Permanent point of known or assumed elevation | 4. Fall |
| _____ e. Proposed or future level of ground at construction line | 5. Grade line |
| _____ f. Stake driven into the ground locating the proposed grade | 6. Grade stake |
| _____ g. Elevation of the level line of sight or of the cross hairs in the telescope with respect to the bench mark (height of instrument above or below bench mark) | 7. Level rod |
| _____ h. Elevation reference point | 8. Height of instrument (HI) |
| _____ i. Level line through the instrument as viewed by the eye | 9. Self-reading rod |
| _____ j. Scale on rod adjusted to height of instrument elevation and direct surface elevation read by instrument man | 10. Differential leveling |
| _____ k. Method of leveling by which the difference in elevation between two points is determined by "+" (plus) and "-" (minus) rod readings which are totaled and adjusted to the bench mark | 11. Temporary bench mark (TBM) |
| _____ l. Reference mark used by bricklayer to indicate 4' intervals above bench mark | 12. Finished floor height |
| _____ m. Elevation of finished floor in relation to bench mark | 13. Four foot masonry reference mark |

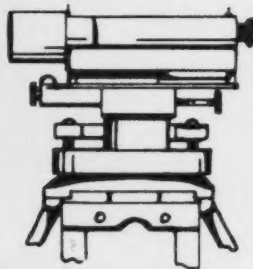
2. Identify the following types of levels.



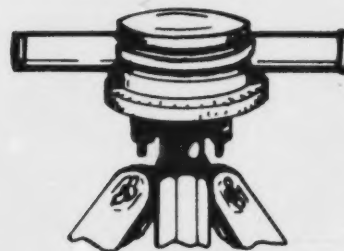
a. _____



b. _____



c. _____



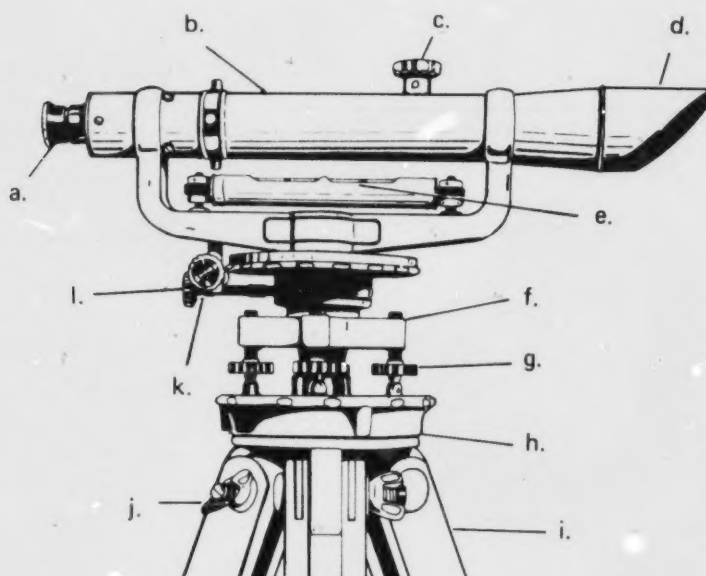
d. _____

3. Name the two types of self-reading rods.

a.

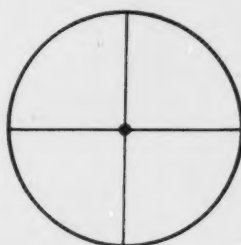
b.

4. Identify the parts of the builder's level by writing the correct names in the blanks.

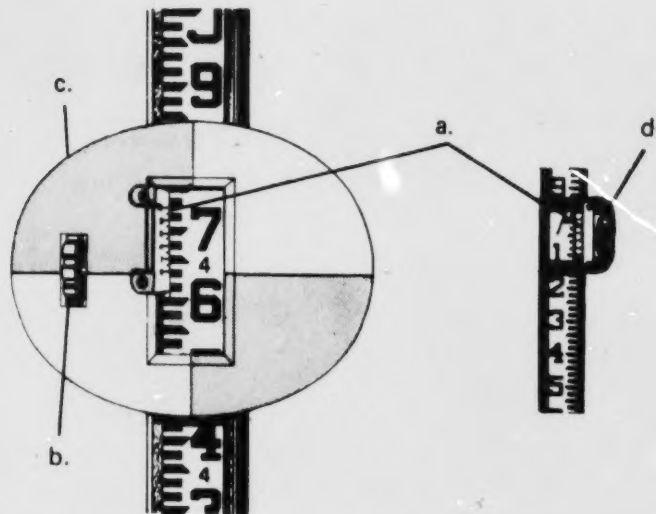


- | | |
|----------|----------|
| a. _____ | g. _____ |
| b. _____ | h. _____ |
| c. _____ | i. _____ |
| d. _____ | j. _____ |
| e. _____ | k. _____ |
| f. _____ | l. _____ |

5. Distinguish between the vertical cross hair and the horizontal cross hair on the builder's level by placing an "X" on the line which indicates the vertical cross hair.



6. Identify the parts of the leveling rod by writing the correct names in the blanks provided.



- a. _____ c. _____
b. _____ d. _____

7. Name four common errors that contribute to incorrect measurement.

- a.
b.
c.
d.

8. List five rules to follow in providing care of the level.

- a.
b.
c.
d.
e.

9. Identify the following hand motions used by the instrument man to guide the target man.



a. _____



b. _____



c. _____



d. _____



e. _____



f. _____

10. Read the self-reading rod.

11. Demonstrate the ability to set up and adjust the builder's level.

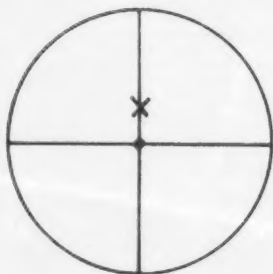
(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

BUILDER'S LEVEL
UNIT IV

ANSWERS TO TEST

1. a. 7 e. 5 i. 3 m. 12
 b. 2 f. 6 j. 9
 c. 4 g. 8 k. 10
 d. 1 h. 11 l. 13
2. a. Builder's
 b. Engineer's dumpy
 c. Engineer's wild tilting
 d. Turret
3. a. Philadelphia or "Philly" rod
 b. Elevation or "Linker" rod
4. a. Eyepiece
 b. Telescope barrel
 c. Focusing screw
 d. Sun shade
 e. Bubble tube
 f. Leveling head
 g. Leveling screw
 h. Head plate
 i. Tripod
 j. Leg thumb nut
 k. Slow motion screw
 l. Clamp

5.



6.
 - a. Vernier scale
 - b. Target clamp
 - c. Target face
 - d. Rod clamp
7.
 - a. Tape not pulled tight enough
 - b. Tape not in proper alignment
 - c. Plumb bob not used when measuring on slope
 - d. Reading or recording the wrong numbers (human errors)
8. Any five of the following:
 - a. Protect against shock and vibration during transport
 - b. Keep in box except when in use
 - c. Place lens and tripod cap in box after removing from instrument
 - d. Attach instrument onto tripod carefully and firmly before moving tripod
 - e. Use sunshade regardless of the weather
 - f. Clean lenses with soft tissue
 - g. Loosen set screws when not in use
9.
 - a. Turning point
 - b. Move in this direction (left)
 - c. Come in

- d. Use long rod
 - e. Observation completed, move on, or understood
 - f. Move down
- 10. Evaluated to the satisfaction of the instructor
 - 11. Performance skills evaluated to the satisfaction of the instructor

[illegible]

[illegible]



SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to distinguish between correct and incorrect ways of holding a trowel, identify methods of picking up mortar, and name factors to consider when placing mortar on brick. The student should also be able to discuss the procedure for spotting the trig and state purposes of racking and walling brick. The student should be able to spread mortar and lay brick and block to a line. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with spreading mortar and laying brick to a line to the correct definitions.
2. Distinguish between the correct and incorrect ways of holding the trowel.
3. Identify methods of picking up mortar from the mortar board.
4. Name purposes of the mason's line.
5. Identify direction of bricklayer's travel for placing mortar while laying brick.
6. Name factors to consider when placing mortar on brick.
7. Identify methods of putting up the line.
8. Discuss procedure for spotting the trig.
9. Identify types of bedding.
10. Label head and bed joints when given an illustration.
11. List the purposes of racking brick.
12. State the purposes of walling brick.
13. Demonstrate the ability to:
 - a. Spread mortar on a 2 x 4 using the western method.
 - b. Spread mortar on a 2 x 4 using the eastern method.

- c. Spread mortar on a 2 x 4 for block.
- d. Build 90° brick leads using the western method.
- e. Build 90° brick leads using the eastern method.
- f. Lay brick to a line with established leads using the western method.
- g. Lay brick to a line with established leads using the eastern method.
- h. Build 90° block leads.
- i. Lay 8" block to a line with established leads.

SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Show examples of tools and demonstrate their use.
- G. Demonstrate and discuss procedures outlined on the job sheets.

(NOTE: Use the job sheets that pertain to your area. Second-year students should build the corner leads; while first-year students should lay brick and block to established leads built by the second-year students.)

- H. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Correct and Incorrect Ways of Holding a Trowel
 - 2. TM 2--Picking Up Mortar from the Mortar Board

3. TM 3--Direction of Travel When Placing Mortar and Laying Brick
4. TM 4--Putting Up Line
5. TM 5--Spotting Trig
6. TM 6--Types of Bedding
7. TM 7--Bed and Head Joints
8. TM 8--Racking Brick
9. TM 9--Walling Brick

D. Job sheets

1. Job Sheet #1--Spread Mortar on a 2 x 4 Using the Western Method
2. Job Sheet #2--Spread Mortar on a 2 x 4 Using the Eastern Method
3. Job Sheet #3--Spread Mortar on a 2 x 4 for Block
4. Job Sheet #4--Build 90° Brick Leads Using the Western Method
5. Job Sheet #5--Build 90° Brick Leads Using the Eastern Method
6. Job Sheet #6--Lay Brick to a Line with Established Leads Using the Western Method
7. Job Sheet #7--Lay Brick to a Line with Established Leads Using the Eastern Method
8. Job Sheet #8--Build 90° Block Leads
9. Job Sheet #9--Lay 8" Block to a Line with Established Leads

E. Test

F. Answers to test

II. References:

- A. Graham, Frank D. *Audels Masons and Builders Guide*. Vol 1. Indianapolis: Theodore Audel and Co./Howard W. Sams and Co., Inc., 1961.
- B. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.
- C. *Masonry*. Memorandum 535. Fort Belvoir, Virginia: U.S. Army Engineer School.

SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Mortar-Combination of cement, lime, sand, and water
- B. Pick and dip-Method of picking up mortar and brick at the same time

(NOTE: This method is also called the *eastern* or *New England* method in some areas of the United States.)
- C. Spreading mortar-Process of placing the mortar on the course that is being laid

(NOTE: This process is called the *western method* in some parts of the United States.)
- D. Mortar body-Mortar which yields a plastic, workable, and trowelable substance
- E. Consistency-Condition of the mortar that is of the same mixture and wetness
- F. Ferrel-Metal band attached around the end of the handle used to attach the handle to the shank of the trowel

(NOTE: It also keeps the handle from splitting.)
- G. Tempering mortar-Softening mortar by adding water and mixing
- H. Story pole-Piece of wood marked for course levels or course heights
- I. Head joint-Vertical mortar joint between ends of masonry units; often called *cross joint*
- J. Bed joint-Horizontal layer of mortar on which a masonry unit is laid
- K. Trig-Tool used to prevent line sag and to prevent movement from wind
- L. Lead-Section of a wall built up and racked back on successive courses

(NOTE: A line is attached to leads as a guide for constructing a wall between them.)
- M. Mason's line-Nylon line used for keeping brick level, straight, and plumb

INFORMATION SHEET

- N. Range line--Line used to keep masonry units on true alignment from corner to corner
 - O. Corner pole--Tool used to establish or check corners and courses of masonry; also called a *deadman*
 - P. Jointer--Tool used to form the joints in masonry work
 - Q. Racking back--Method of stepping back successive courses of masonry
- II. Correct and incorrect ways of holding a trowel (Transparency 1)

A. Correct

(NOTE: The palm of the hand should be up with the thumb on top of the ferrel. The handle should be held firmly but loosely and pressure should be between thumb and forefinger.)



B. Incorrect



III. Methods of picking up mortar from the mortar board (Transparency 2)

A. From the side

(NOTE: This method is the most widely used.)

B. From the middle

C. From the top

(NOTE: Keep mortar well rounded on the board.)

INFORMATION SHEET

IV. Purposes of the mason's line

- A. Keep masonry walls in true alignment
- B. Keep course straight, plumb, and level

V. Direction of travel for placing mortar (Transparency 3)

- A. Laying brick to your hand

(NOTE: Bricklayer walks forward.)

- B. Laying brick backhand or against hand

(NOTE: Bricklayer walks backwards.)

- C. Laying brick overhand

(NOTE: This is used when laying brick on the outside with the scaffold on the inside. You also lay with or against hand when laying brick overhand.)

VI. Factors to consider when placing mortar

- A. Keep mortar well rounded on board
- B. Keep mortar tempered
- C. Keep trowel clean

VII. Methods of putting up line (Transparency 4)

- A. Line blocks
- B. Line pins
- C. Corner pole

VIII. Procedure for spotting the trig (Transparency 5)

- A. Spot brick for trig
- B. Attach trig to line
- C. Secure trig with dry brick
- D. Sight the line

(NOTE: A trig is used on long walls to take sag out of the line and movement from the wind.)

INFORMATION SHEET

IX. Types of bedding (Transparency 6)

- A. Face shell bedding
- B. Full mortar bedding

X. Types of joints (Transparency 7)

- A. Bed joint

(NOTE: The bed joint is referred to as the *horizontal joint*. It also refers to the mortar on which the brick rest.)

- B. Head joint

(NOTE: The head joint is referred to as the *vertical joint*. It is also the joint between the ends of two bricks on the same course and is sometimes referred to as the *cross joint*.)

XI. Purposes of racking brick (Transparency 8)

- A. Build a lead
- B. Determine course height

XII. Purposes of walling brick (Transparency 9)

- A. Save time
- B. Save motion

(NOTE: It is used as often as possible.)

Correct and Incorrect Ways of Holding a Trowel

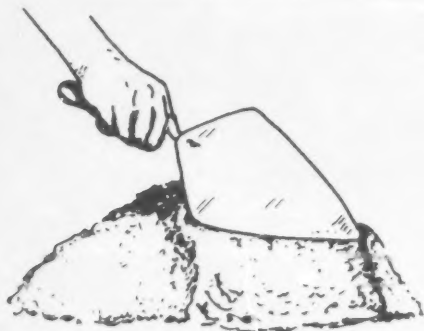


Correct



Incorrect

Picking Up Mortar from the Mortar Board



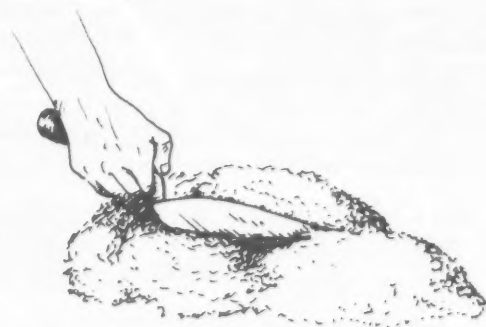
Rounding Up Mortar



From The Side

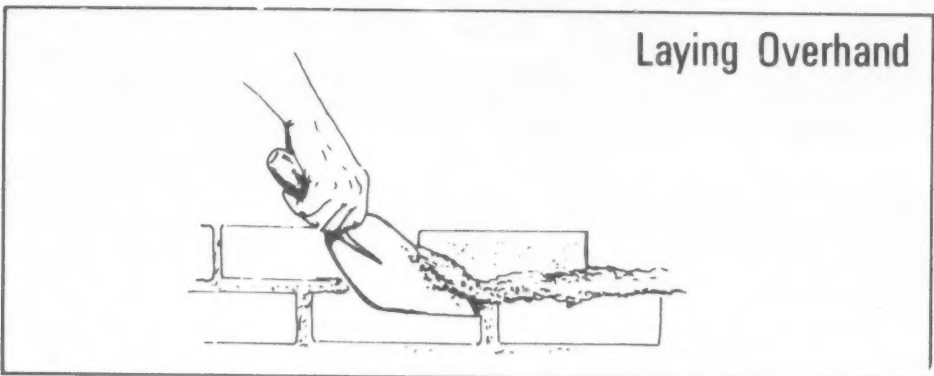
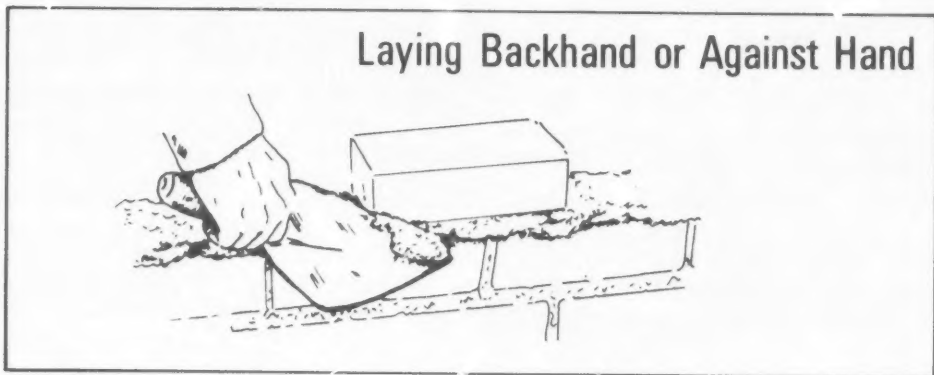
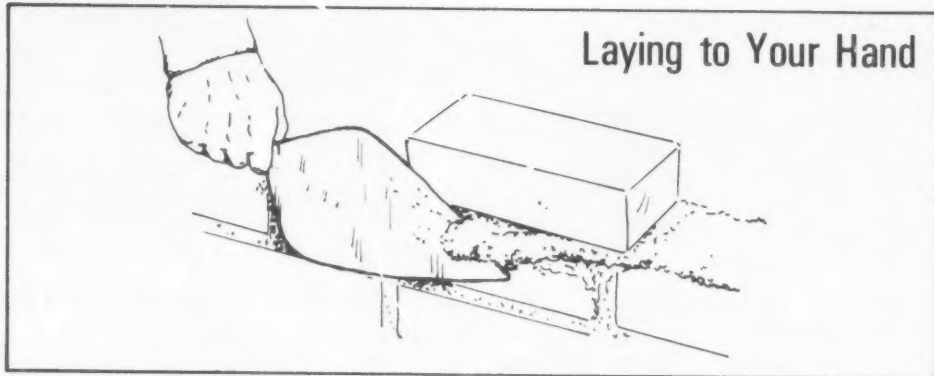


From The Middle

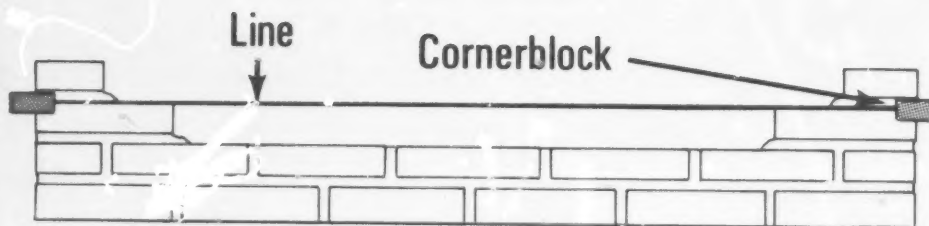


From The Top

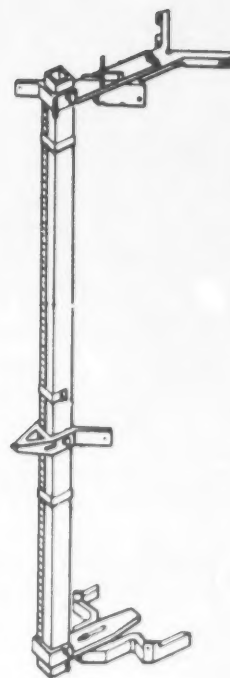
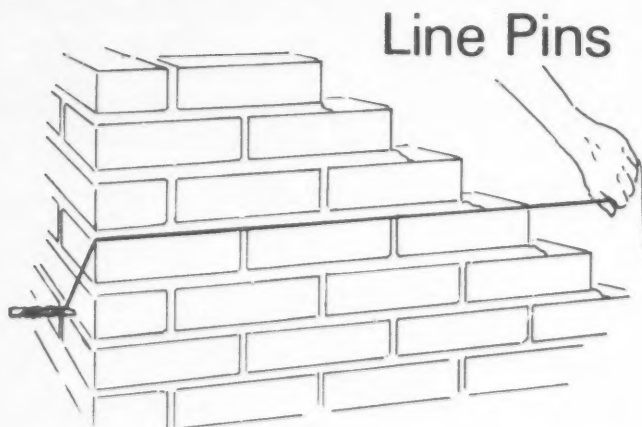
Direction of Travel When Placing Mortar and Laying Brick



Putting Up Line

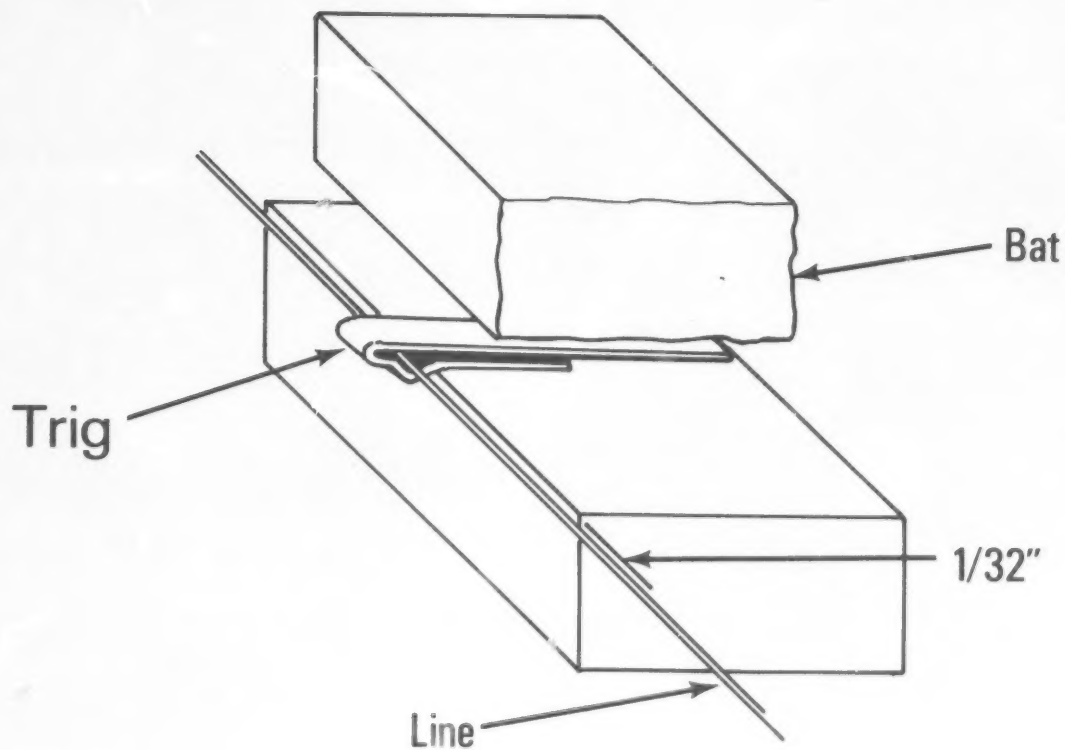


Line Blocks

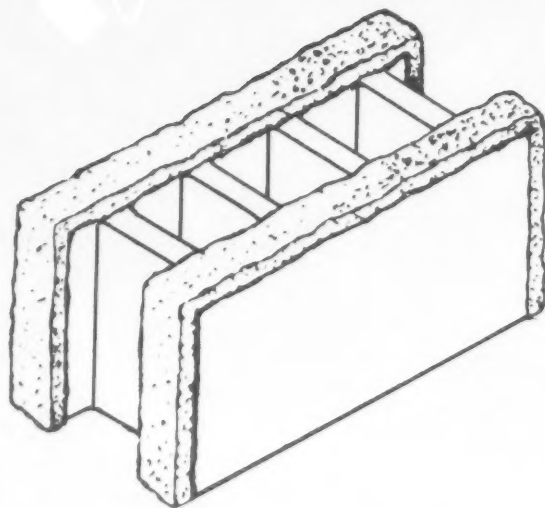


Corner Pole

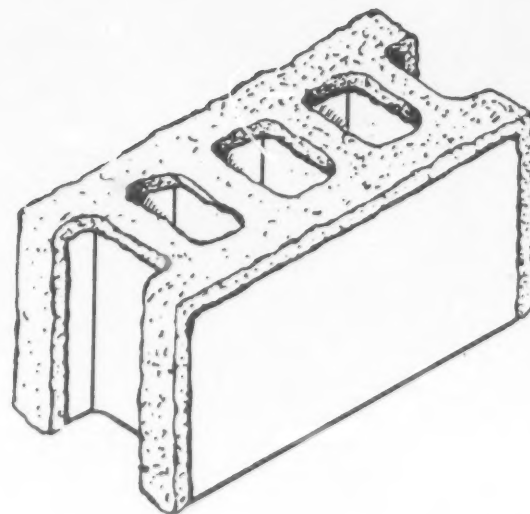
Spotting Trig



Types of Bedding

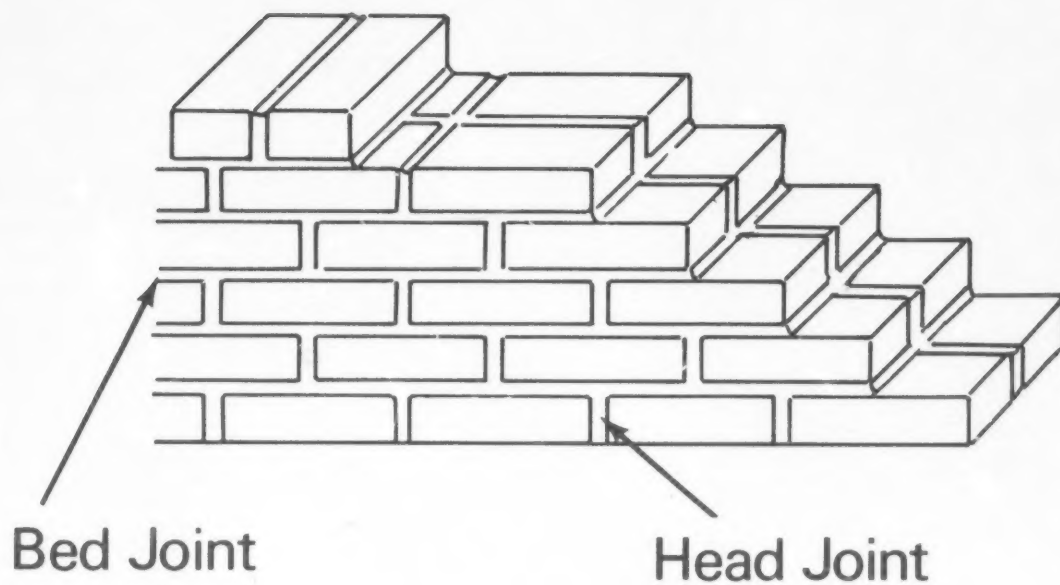


Face Shell

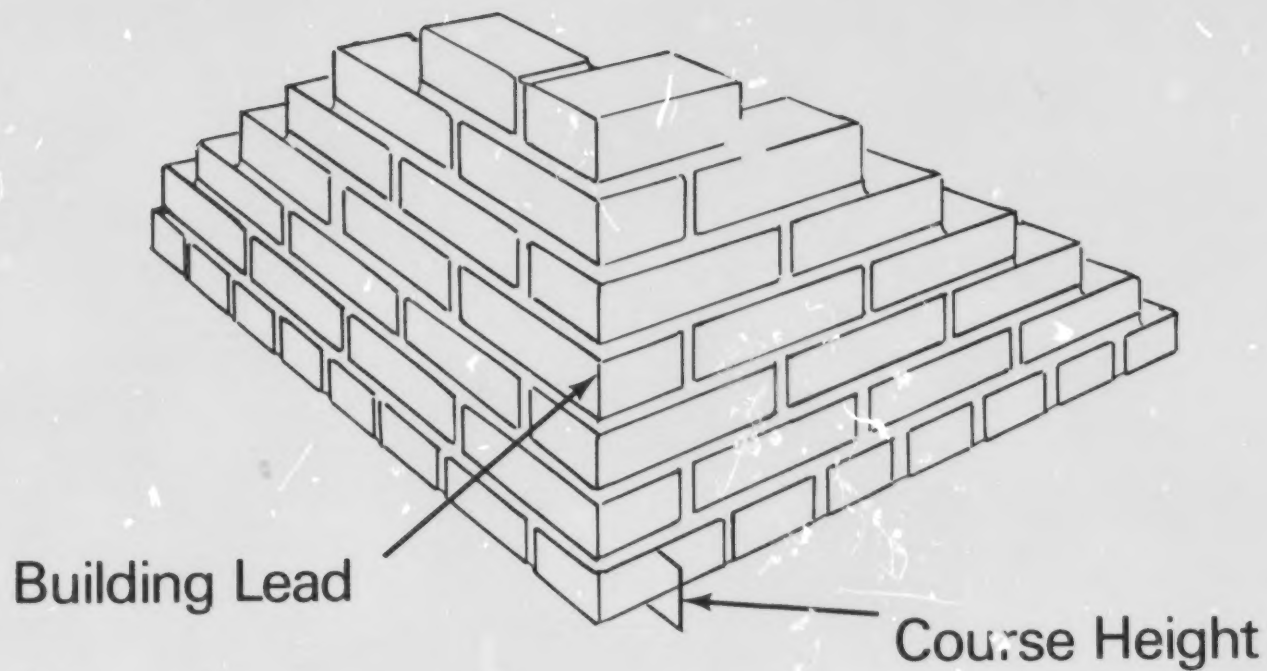


Full Mortar

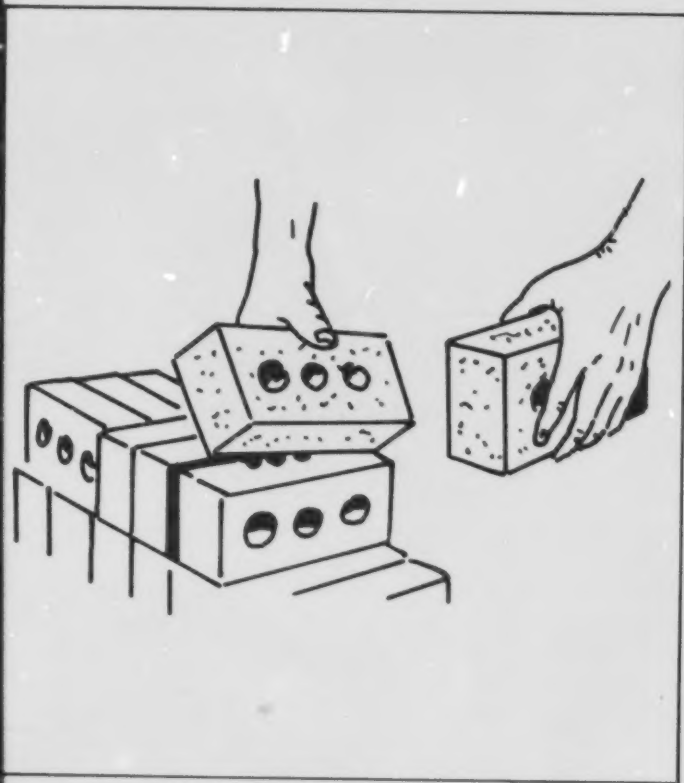
Bed and Head Joints



Racking Brick



Walling Brick



SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #1--SPREAD MORTAR ON A 2 x 4 USING THE WESTERN METHOD

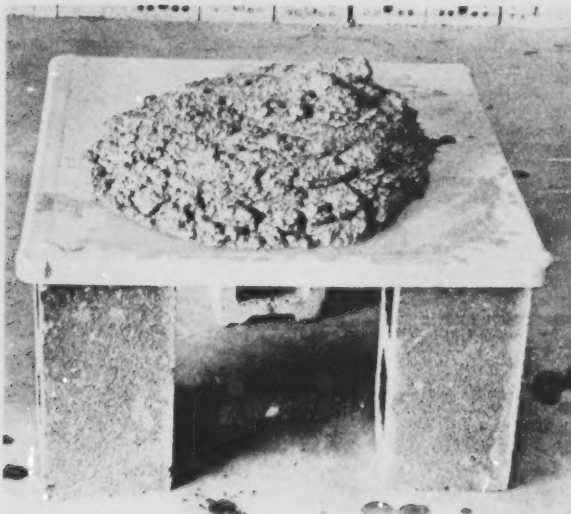
I. Tools and materials

- A. Trowel
- B. Mortar board
- C. Laboratory mortar
- D. Pail, 5 gallon
- E. 2 x 4s

II. Procedure

- A. Position mortar board 16" off the floor
- B. Wet mortar board
- C. Secure mortar and place in center of board (Figure 1)

FIGURE 1



JOB SHEET #1

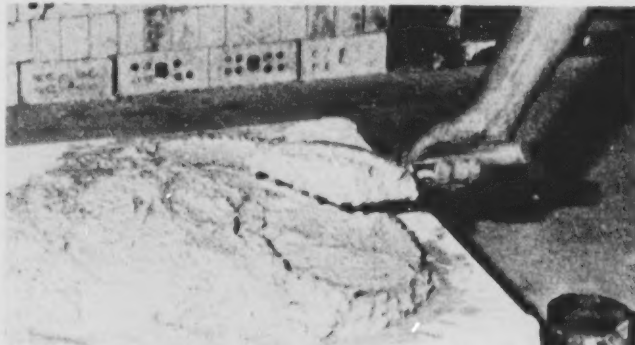
- D. Place trowel in hand, holding trowel firmly but loosely (Figure 2)

FIGURE 2



- E. Continue to move trowel in hand in order to gain feel and proper movement
- F. Cut out a trowel of mortar from the side of the mortar board (Figure 3)

FIGURE 3



(NOTE: Continue this exercise until you have the feel of the trowel containing mortar.)

JOB SHEET #1

- G. Place mortar board and 2 x 4 approximately two feet apart (Figure 4)

FIGURE 4



- H. Pick up a trowel of mortar and spread the mortar on the 2 x 4 (Figure 5)

(NOTE: This placement of mortar should be enough for the bonding of three or four bricks.)

FIGURE 5



JOB SHEET #1

- I. Continue picking up mortar and placing on 2 x 4 until the 2 x 4 is covered (Figure 6)

(NOTE: The mortar should be placed on the 2 x 4, avoiding waste and keeping the mortar thickness constant.)

FIGURE 6



- J. Keep a solid bed joint with little or no furrowing
K. Check with instructor for evaluation
L. Remove mortar and place on mortar board

(NOTE: Temper if needed to keep same consistency; keep trowel clean.)

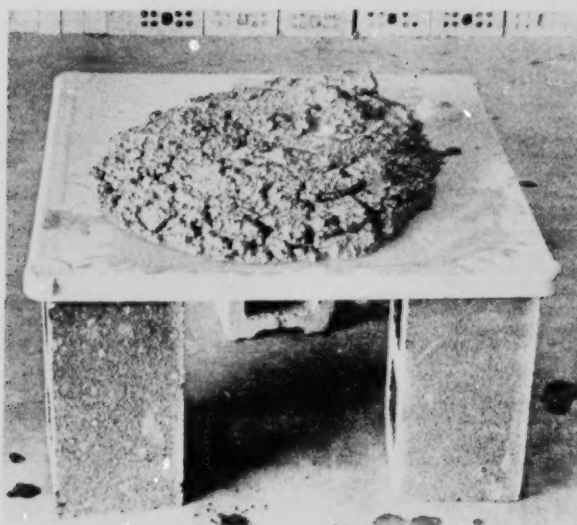
- M. Repeat procedure

SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

JOB SHEET #2--SPREAD MORTAR ON A 2 x 4 USING THE EASTERN METHOD

- I. Tools and materials
 - A. Trowel
 - B. Mortar board
 - C. Laboratory mortar
 - D. Pail of water
 - E. 2 x 4s
- II. Procedure
 - A. Position mortar board 16" off the floor
 - B. Wet mortar board
 - C. Secure mortar and place in center of board (Figure 1)

FIGURE 1



JOB SHEET #2

- D. Place trowel in hand, holding trowel firmly but loosely (Figure 2)

FIGURE 2



- E. Continue to move trowel in hand in order to gain feel and proper movement
F. Cut out a trowel of mortar from the mortar board (Figure 3)

FIGURE 3



(NOTE: Continue this exercise until you have the feel of the trowel containing mortar.)

JOB SHEET #2

- G. Place mortar board and 2 x 4 approximately two feet apart (Figure 4)

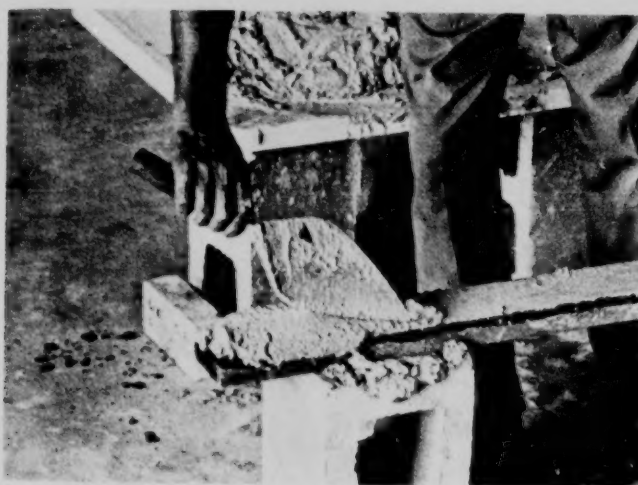
FIGURE 4



- H. Pick up a trowel of mortar and place the mortar on the 2 x 4 (Figure 5)

(NOTE: This placement of mortar should be enough for the bonding of one brick.)

FIGURE 5

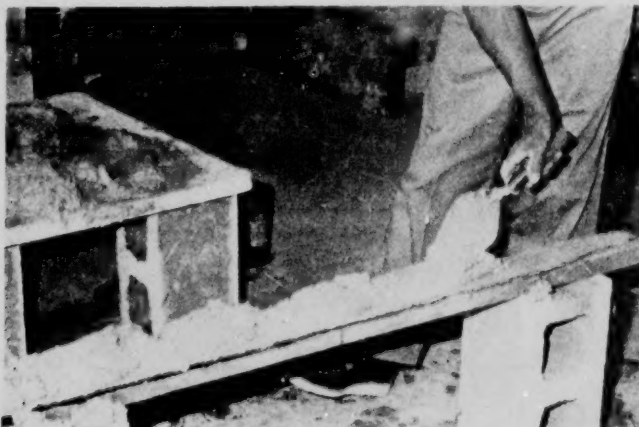


JOB SHEET #2

- I. Continue picking up mortar and placing on 2 x 4 until the 2 x 4 is covered (Figure 6)

(NOTE: The mortar should be placed on the board, avoiding waste and keeping the mortar thickness constant.)

FIGURE 6



- J. Check with instructor for evaluation
- K. Remove mortar and place on mortar board

(NOTE: Temper mortar if needed to keep same consistency; keep trowel clean.)

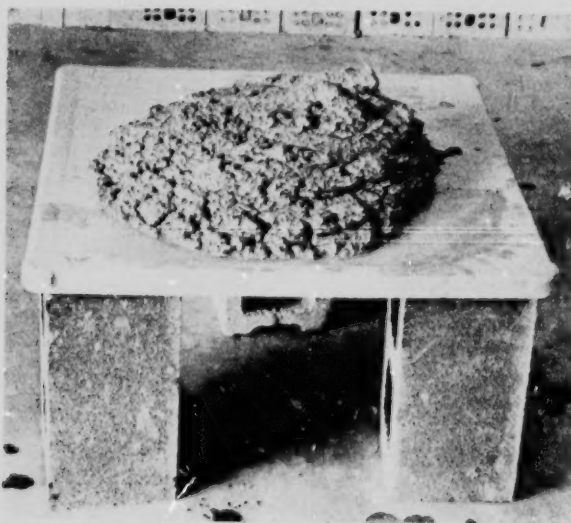
- L. Repeat procedure

SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #3-SPREAD MORTAR ON A 2 x 4 FOR BLOCK

- I. Tools and materials
 - A. Trowel
 - B. Mortar board
 - C. Laboratory mortar
 - D. Pail of water
 - E. 2 x 4s
- II. Procedure
 - A. Position mortar board 16" off the floor
 - B. Wet mortar board
 - C. Secure mortar and place in center of board (Figure 1)

FIGURE 1



JOB SHEET #3

- D. Place trowel in hand, holding trowel firmly but loosely (Figure 2)

FIGURE 2



- E. Continue to move trowel in hand in order to gain feel and proper movement
- F. Cut out a trowel of mortar from the side of the mortar board (Figure 3)

FIGURE 3



(NOTE: Continue this exercise until you have the feel of the trowel containing mortar.)

JOB SHEET #3

- G. Place mortar board and 2 x 4 approximately two feet apart

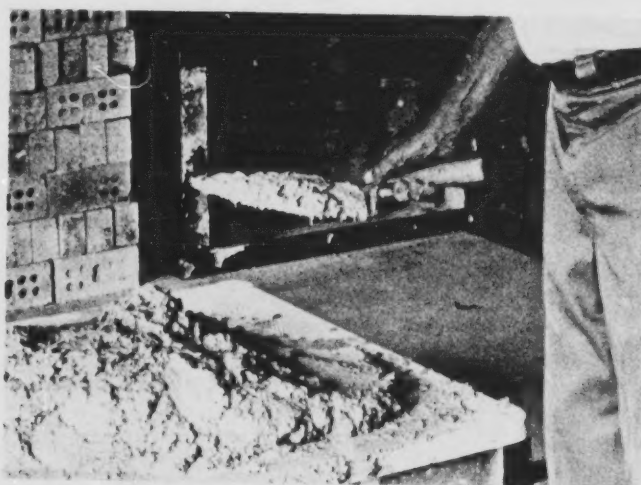
(NOTE: Keep 2 x 4 approximately 16" from floor. See Figure 4.)

FIGURE 4



- H. Take a trowel full of mortar from the board, shaking the trowel with a quick vertical snap of the wrist to make the mortar stick to the trowel (Figure 5)

FIGURE 5



JOB SHEET #3

- I. Place mortar on 2 x 4 for face shell bedding leaving only enough mortar for one-inch thickness (Figure 6)

FIGURE 6



(NOTE: Place mortar on outside edges of 2 x 4. See Figure 7.)

FIGURE 7



- J. Keep a solid bed of mortar one inch thick and with a minimum of trips to the mortar board

(NOTE: In some areas specifications call for full bedding.)

- K. Check with instructor for evaluation

- L. Remove mortar and place on mortar board

(NOTE: Temper mortar if needed to keep the same consistency; keep trowel clean.)

- M. Repeat procedure

SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #4--BUILD 90° BRICK LEADS USING THE WESTERN METHOD

(NOTE: This job sheet should be used by second-year students.)

- I. Tools and materials
 - A. Steel tape, 50' or 100'
 - B. Bricklayer's modular rule
 - C. Trowel
 - D. Hammer
 - E. Level, 4'
 - F. Dusting brush
 - G. Round jointer
 - H. Nylon line
 - I. Framing square
 - J. Chalk line
 - K. Masonry saw
 - L. Line pins
 - M. Line blocks
 - N. Trig
 - O. Brick set
 - P. Mortar boards
 - Q. Laboratory mortar
 - R. Water pail
 - S. Face brick
 - T. Story pole
 - U. Marking pencil

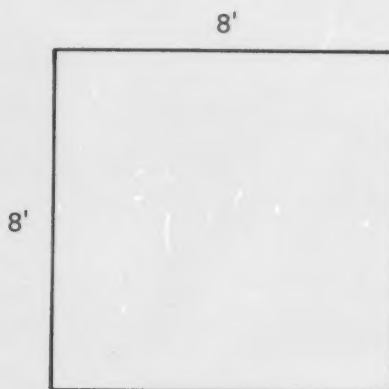
JOB SHEET #4

II. Procedure

(NOTE: The instructor should designate starting point.)

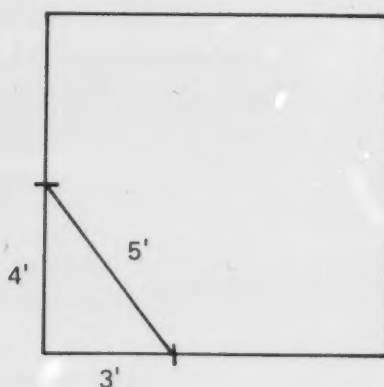
A. Chalk wall lines on floor (Figure 1)

FIGURE 1



B. Check squareness of chalk lines using the 3' - 4' - 5' method with steel tape (Figure 2)

FIGURE 2



C. Check with instructor for evaluation

JOB SHEET #4

- D. Lay out a dry brick bond for a wall 8' long (Figure 3)

FIGURE 3



- E. Mark on floor the location of the ends of each brick (Figure 4)

(NOTE: The end of each brick should be marked in order to keep full bond.)

FIGURE 4



- F. Remove all of the dry bond by pushing the brick to the outside so that you will have enough room to lay first course of bricks or start corner leads

JOB SHEET #4

G. Lay first course of brick for a six course lead

1. Spread enough mortar for three bricks
2. Pick up full brick and press it firmly so that you will have a $\frac{3}{8}$ " bed joint, keeping face and end of brick with chalk line on floor (Figure 5)

FIGURE 5



3. Lay the two remaining bricks on lead by shoving brick into mortar and taking enough mortar on end of brick to completely fill head joint (Figure 6)

(NOTE: Remove mortar at base of brick and make sure bricks are with chalk line and with bond marks on the floor.)

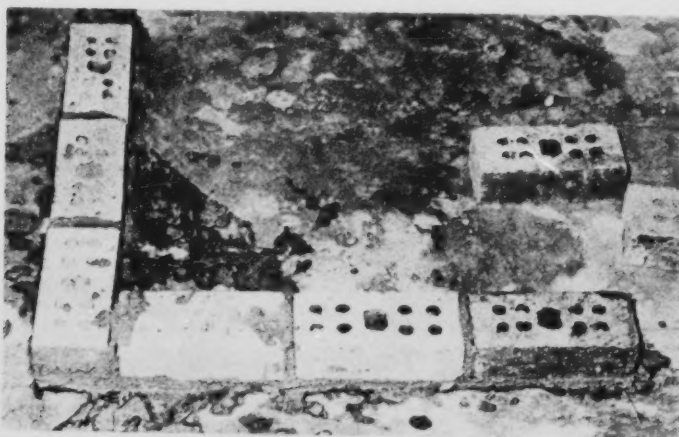
FIGURE 6



JOB SHEET #4

4. Spread mortar for three bricks for return of lead
5. Lay three bricks, keeping a $3/8$ " bed joint and head joints filled solid (Figure 7)

FIGURE 7



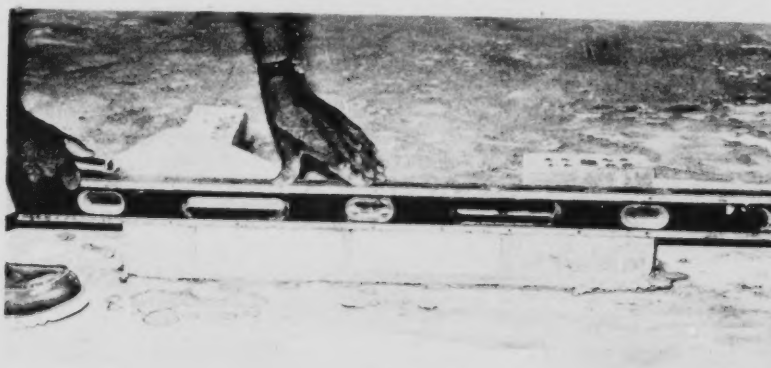
6. Remove mortar at base of brick

(NOTE: Make sure face of brick is with chalk line on floor and with end of bond marks.)

- H. Pick up level with left hand, set on top of course laid, and check for level (Figure 8)

(NOTE: If brick course is not level, tap slightly with trowel at high end.)

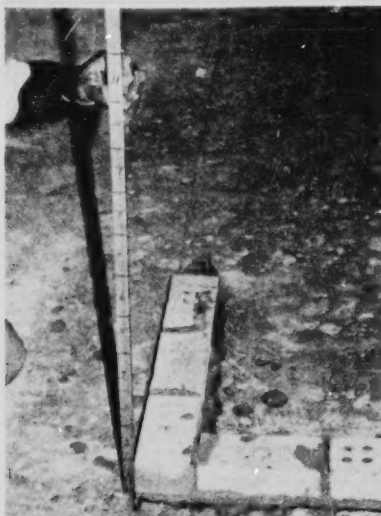
FIGURE 8



JOB SHEET #4

- I. Check course height by using story pole (Figure 9)

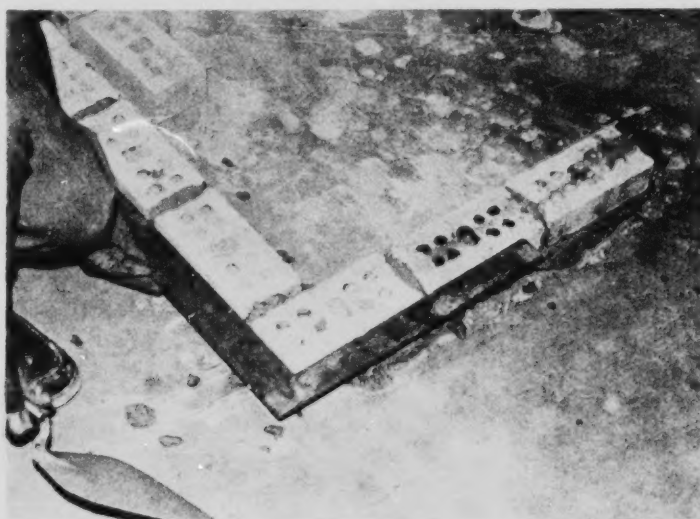
FIGURE 9



- J. Check course laid on lead for squareness with framing square (Figure 10)

(NOTE: First course of lead should be with chalk lines and should be perfectly square.)

FIGURE 10



(NOTE: In some areas a square is not used; a bricklayer's level is used as a straight edge for alignment of brick or block.)

JOB SHEET #4

K. Spread mortar for three bricks for second course of lead

1. Lay bricks, keeping a $\frac{3}{8}$ " bed joint and head joints filled solid and keeping face of brick with brick face on first course (Figures 11a and 11b)

FIGURE 11a



FIGURE 11b



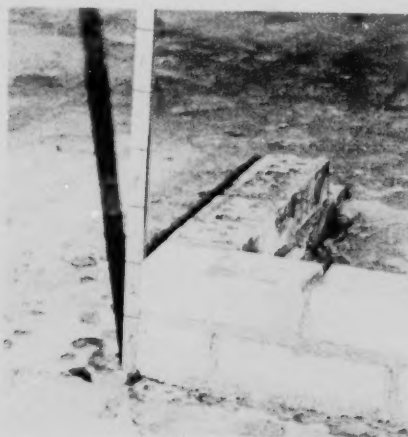
(NOTE: Cut mortar from bed joints and head joints, being careful not to smear or stain face of brick.)

2. Spread mortar for two bricks on return of lead
3. Lay two bricks, keeping $\frac{3}{8}$ " bed joint and head joints filled solid
4. Level the course just laid; check for course height using the story pole (Figures 12a and 12b)

FIGURE 12a



FIGURE 12b



JOB SHEET #4

5. Plumb the corners on lead with level, making sure that they are perfectly plumb
6. Check the range of the lead by holding level diagonally from the corner to the bricks laid on the first course (Figure 13)

(NOTE: This is done on both faces of the lead.)

FIGURE 13



L. Lay third course

1. Spread mortar for two bricks for course three
2. Lay brick, keeping face of brick with face of brick on second course
3. Spread mortar for two bricks on return of lead, keeping a 3/8" bed joint and making sure head joints are filled solid
4. Level course
5. Check course height with story pole
6. Plumb corners

JOB SHEET #4

7. Check range at both tails of lead (Figure 14)



FIGURE 14

- M. Proceed to lay the remaining three courses on lead using the same procedures that were used to lay the first three courses

1. Keep head joints filled solid
2. Keep course level
3. Check with story pole for course height
4. Make sure corners are plumb and tails are on range

(NOTE: For the last three courses on a lead, it is a good practice to sight the corner brick that are going to be laid with the three courses that have been plumbed. See Figure 15.)



FIGURE 15

JOB SHEET #4

- N. Proceed to lay the three remaining corners using the same procedures for building a lead (Figure 16)

FIGURE 16



SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #5--BUILD 90° BRICK LEADS USING THE EASTERN METHOD

(NOTE: This job sheet should be used by second-year students.)

I. Tools and material

- A. Steel tape, 50' or 100'
- B. Bricklayer's modular rule
- C. Trowel
- D. Hammer
- E. Level, 4'
- F. Dusting brush
- G. Round jointer
- H. Nylon line
- I. Framing square
- J. Chalk line
- K. Masonry saw
- L. Line pins
- M. Line blocks
- N. Trig
- O. Brick set
- P. Mortar board
- Q. Laboratory mortar
- R. Water pail
- S. Face brick
- T. Story pole
- U. Marking pencil

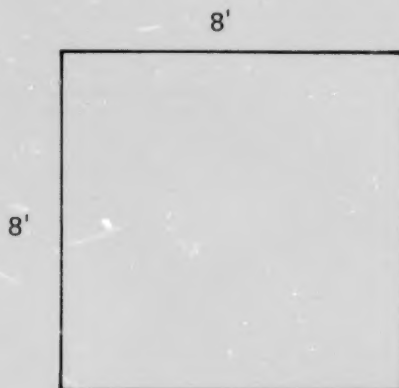
JOB SHEET #5

II. Procedure

(NOTE: The instructor should designate the starting point.)

- A. Chalk wall lines on floor (Figure 1)

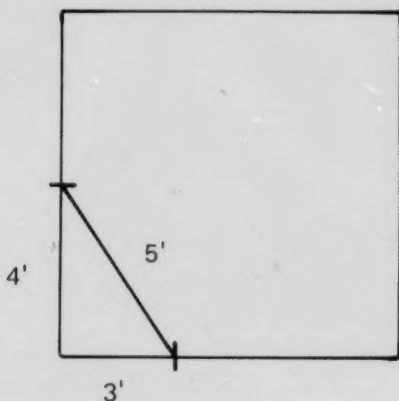
FIGURE 1



- B. Check squareness of chalk lines using the 3' - 4' - 5' method with steel tape (Figure 2)

(NOTE: This should be done on every corner.)

FIGURE 2



- C. Check with instructor for evaluation

JOB SHEET #5

- D. Lay out a dry brick bond for each wall 8' long (Figure 3)

(NOTE: An eight foot wall will require 12 bricks with approximately $\frac{3}{8}$ " for each head joint.)

FIGURE 3



- E. Mark on floor the location of the ends of each brick (Figure 4)

(NOTE: The end of each brick should be marked in order to keep full bond.)

FIGURE 4



JOB SHEET #5

- F. Remove all of the dry bond by pushing the brick to the inside so that there will be enough room to lay first course of brick or to start the corner leads

(NOTE: A 16" concrete block may be used as a "deadman" to secure line to assure proper alignment. Course height can also be marked on concrete block. See Figures 5a and 5b.)

FIGURE 5a

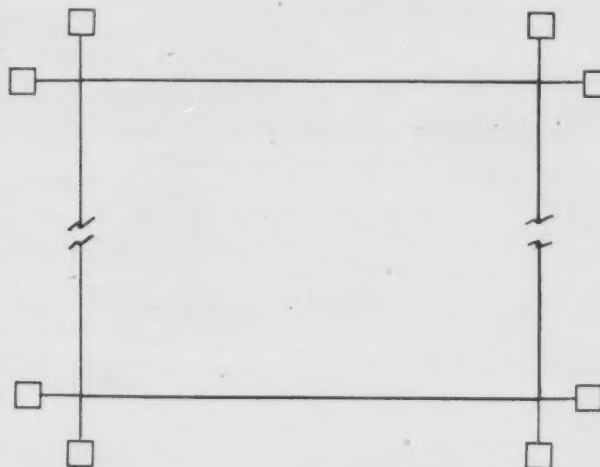
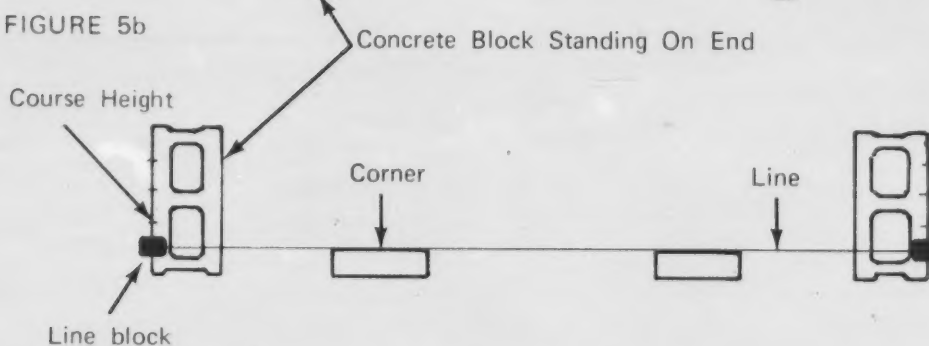


FIGURE 5b



- G. Lay first course of brick for a six course lead

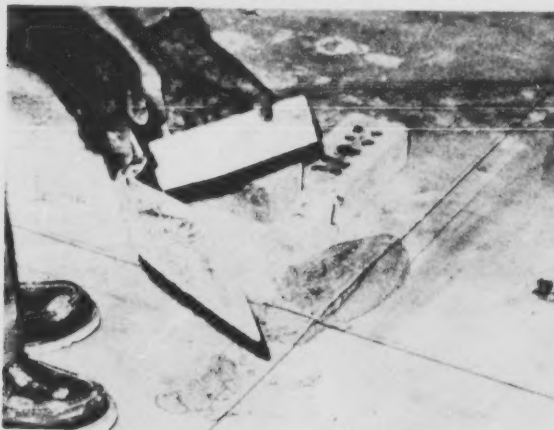
1. Pick up and place mortar for one brick at corner or starting point
2. Pick up brick

JOB SHEET #5

3. Place brick at corner and press firmly to seat to a $\frac{3}{8}$ " bed joint (Figure 6)

(NOTE: Keep face and end of brick in proper alignment with chalk line on floor.)

FIGURE 6



4. Remove excess mortar from sides and end of brick and return to mortar board
5. Pick up second brick
6. Pick up and place enough mortar for one brick next to brick previously laid
7. Position second brick by taking enough mortar on brick to shove a full head joint
8. Repeat process for one more brick (Figure 7)

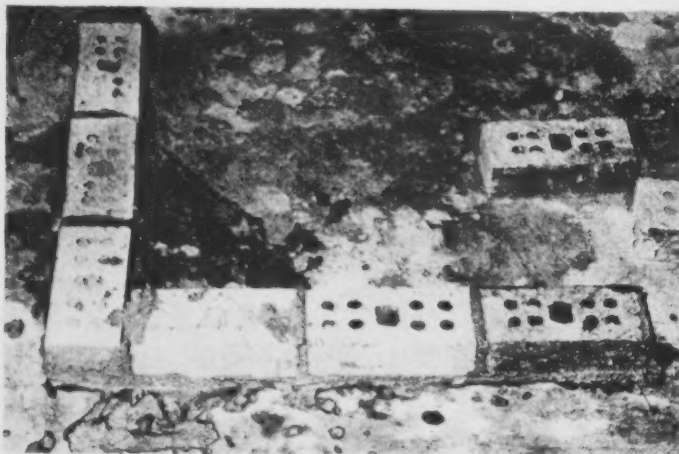
FIGURE 7



JOB SHEET #5

9. Pick up mortar for one brick and place for first brick on return wall
10. Position brick by shoving brick into mortar, taking enough mortar on end of brick to fill head joint
11. Remove excess mortar from sides and end of brick and return to mortar board
12. Repeat steps for two more bricks (Figure 8)

FIGURE 8



13. Pick up level with left hand, set on top of course laid, and check for levelness (Figure 9)

(NOTE: If brick course is not level, tap slightly with trowel at high end.)

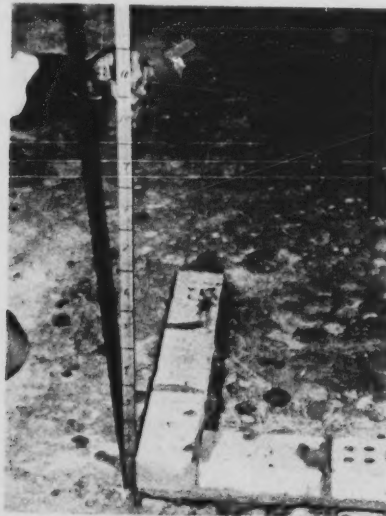
FIGURE 9



JOB SHEET #5

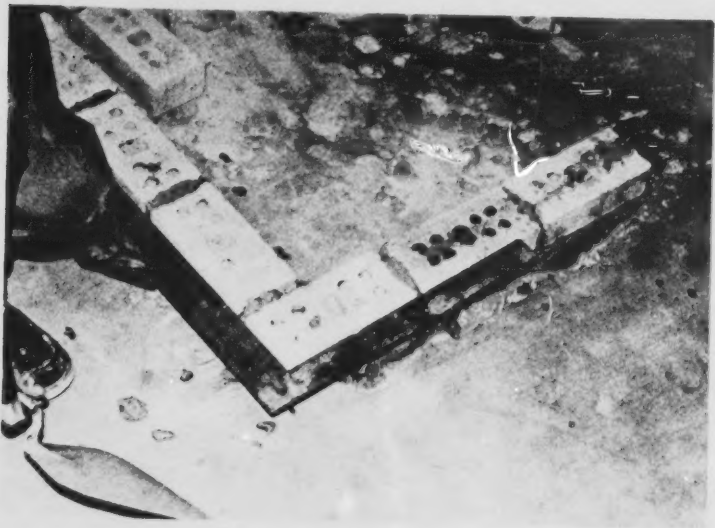
14. Check course height by using story pole (Figure 10)

FIGURE 10



15. Check course squareness at corner using a framing square (Figure 11)

FIGURE 11



H. Lay second course on corner lead

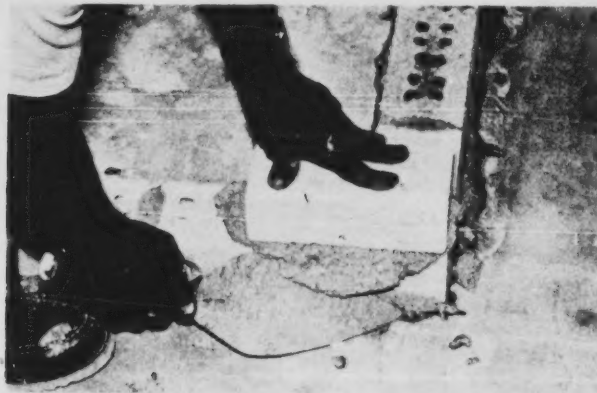
1. Pick up mortar for one brick and place on top of first course at corner

JOB SHEET #5

2. Pick up and position brick, keeping a 3/8" bed joint (Figure 12)

(NOTE: Be careful to keep end and face of brick in proper alignment and plumb with brick on first course.)

FIGURE 12



3. Remove excess mortar and return to mortar board
4. Pick up enough mortar for one brick
5. Place mortar next to previously laid brick
6. Position brick by shoving into mortar and taking enough mortar on end to fill head joint
7. Apply pressure to seat brick to 3/8" bed joint
8. Cut mortar from sides of head and bed joints and return to mortar board (Figure 13)

FIGURE 13



JOB SHEET #5

9. Pick up enough mortar for one brick
10. Place mortar next to previously laid brick
11. Position brick by taking enough mortar on end of brick to shove a full head joint
12. Apply pressure to top of brick to seat to $\frac{3}{8}$ " bed joint
13. Cut mortar from sides of head and bed joints and return to mortar board (Figure 14)

FIGURE 14

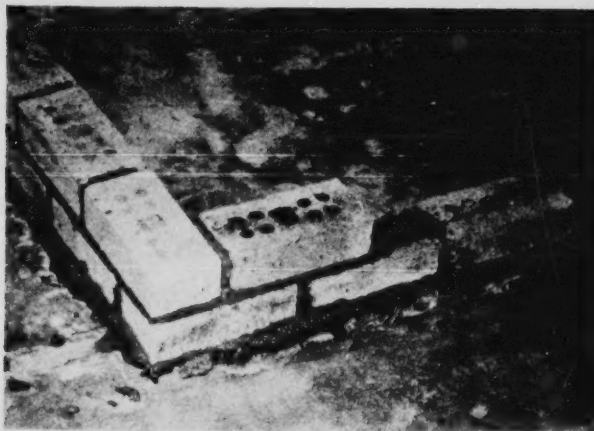


14. Pick up enough mortar for one brick
15. Place mortar next to corner brick on return wall
16. Pick up and position brick by taking enough mortar on end of brick to shove a full head joint
17. Apply pressure to top of brick to seat to $\frac{3}{8}$ " bed joint

JOB SHEET #5

18. Cut mortar from sides of bed and head joints and return to mortar board (Figure 15)

FIGURE 15



19. Pick up enough mortar for one brick
20. Place mortar next to previously laid brick
21. Pick up and position brick by taking enough mortar on end of brick to shove a full head joint
22. Apply pressure to top of brick to seat to $\frac{3}{8}$ " bed joint
23. Cut mortar from sides of bed and head joints and return to mortar board (Figure 16)

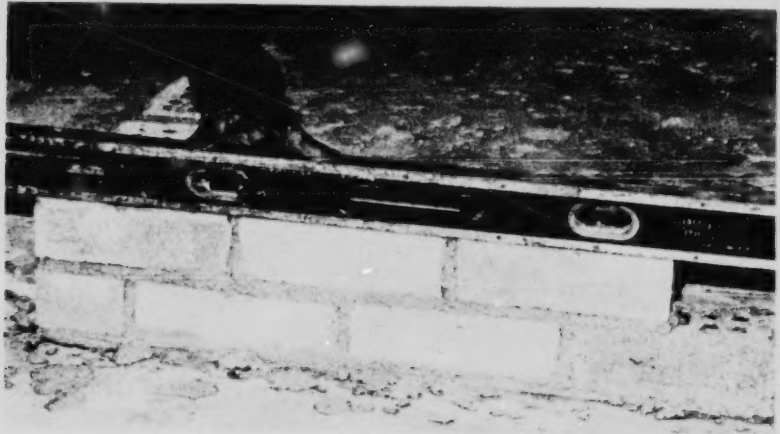
FIGURE 16



JOB SHEET #5

24. Check level across top of second course with 4' level (Figure 17)

FIGURE 17



25. Check course height with story pole (Figure 18)

FIGURE 18



26. Check corner to see if it is plumb

JOB SHEET #5

27. Hold level diagonally from corner to end of brick on first course to check for alignment (Figure 19)

(NOTE: Check alignment on both wall leads.)

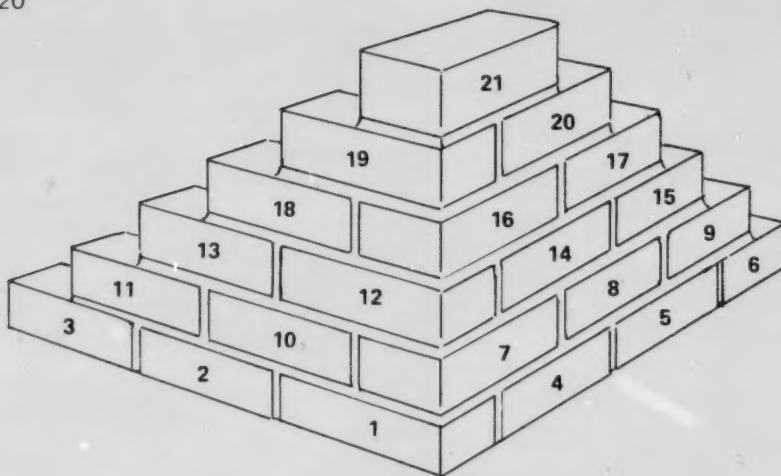


FIGURE 19

- I. Repeat procedures for four more courses of brick

(NOTE: Finished lead should look like the lead in Figure 20. Figure 20 also shows the numerical order in which bricks should be laid.)

FIGURE 20



JOB SHEET #5

- J. Repeat the procedures for the three remaining corner leads
1. Keep head joints filled solid
 2. Keep course level
 3. Check each course height with story pole
 4. Make sure corners are plumb and tails are on range
- K. Check with instructor for evaluation

SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

JOB SHEET #6--LAY BRICK TO A LINE WITH ESTABLISHED LEADS USING THE WESTERN METHOD

(NOTE: First-year students should use leads constructed by the second-year students.)

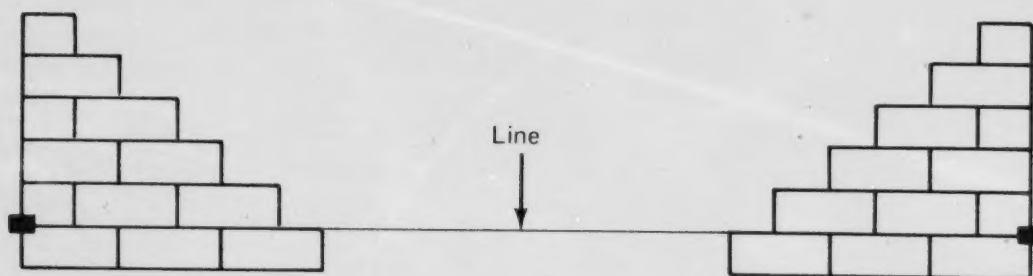
I. Tools and materials

- A. Trowel
- B. Brick hammer
- C. Mortar boards
- D. Laboratory mortar
- E. Pail, 5 gallon
- F. Mason's line
- G. Line blocks
- H. Bricks, approximately 204

II. Procedure

- A. Secure line using line blocks, making sure line is tight and has no sag (Figure 1)

FIGURE 1



JOB SHEET #6

- B. Spread mortar for three or four bricks (Figure 2)

FIGURE 2



1. Pick up brick and place enough mortar on end of brick so that you will have a full head joint (Figure 3)

FIGURE 3



(NOTE: Make sure to keep ends of brick with dry bond marks on floor.)

JOB SHEET #6

2. Apply pressure to top of brick with fingers, keeping brick with top of line and so you can see daylight between face of brick and line (Figure 4)

FIGURE 4



3. Cut mortar off head joint and at base of brick and place it on end of brick just laid

(NOTE: This is done for each brick laid to the line. See Figure 5.)

FIGURE 5



4. Continue laying brick to the line until you come to the last brick to be laid or the closure brick

JOB SHEET #6

5. Lay closure brick

- a. Butter the ends of the bricks already laid and both ends of brick to be laid (Figures 6a and 6b)

FIGURE 6a

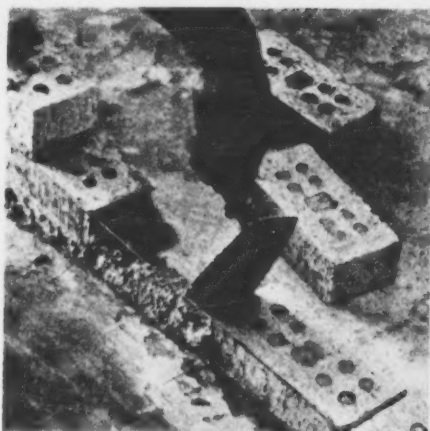
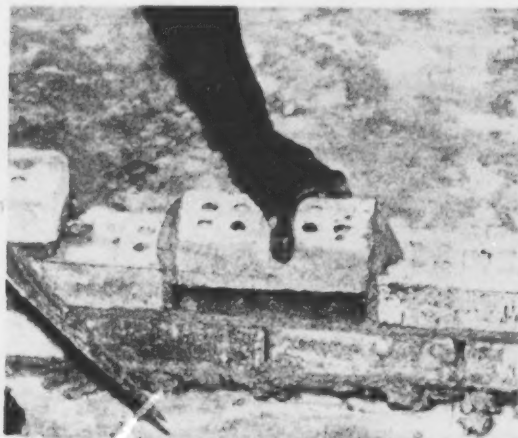


FIGURE 6b



- b. Press brick down firmly with fingers, keeping brick with top of line (Figure 7)

FIGURE 7



(NOTE: Check bricks that have been laid to the line, making sure bricks are with top of line and so you can see daylight between line and face of brick.)

JOB SHEET #6

- C. Raise line blocks for second course, making sure line is with top of brick on second course of leads (Figure 8)

FIGURE 8



- D. Spread mortar for three or four bricks and continue to lay bricks to the line, making sure to stay half bond with brick laid on first course

(NOTE: The first two courses will establish the bond for the remaining courses to be laid. See Figure 9.)

FIGURE 9



JOB SHEET #6

E. Raise line blocks for third course making sure line is tight and has no sag

1. Lay brick on third course
2. Sight the end of brick with the end of brick on first course

(NOTE: This will assure a plumb bond. See Figure 10.)

FIGURE 10



F. Continue to raise the line and lay brick to the line for the remaining courses

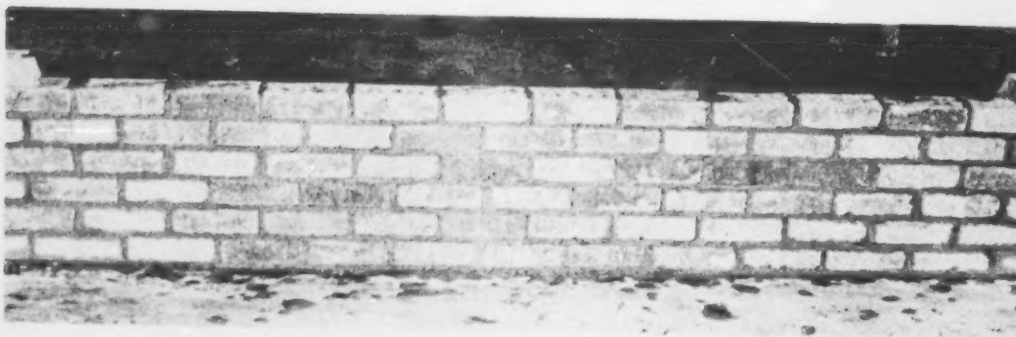
(NOTE: Refer to Figure 11 on the following page.)

1. Spread mortar for three or four bricks
2. Make sure head joints are filled solid
3. Keep top of bricks with top of line
4. Make sure you can see daylight between face of brick and line

JOB SHEET #6

5. Sight ends of brick with course below to maintain a plumb bond
(NOTE: Keep mortar well tempered.)

FIGURE 11

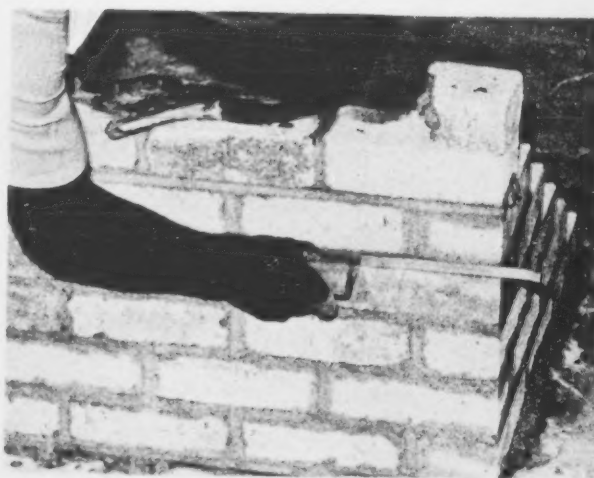


- G. Proceed to joint the vertical and horizontal joints with the round jointer
(NOTE: The round jointer should be slightly larger than the mortar joints.)
- H. Hold round jointer firmly in right hand and joint the vertical or head joints; joint the bed joints (Figures 12a and 12b)

FIGURE 12a



FIGURE 12b



SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

JOB SHEET #7--LAY BRICK TO A LINE WITH ESTABLISHED LEADS USING THE EASTERN METHOD

(NOTE: First-year students should use leads constructed by the second-year students.)

I. Tools and materials

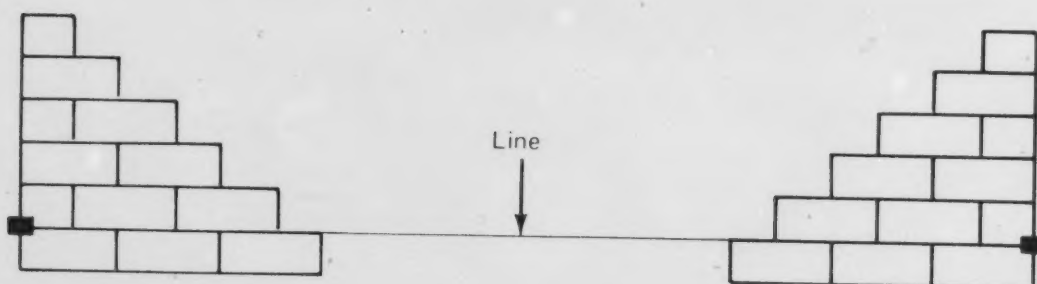
- A. Trowel
- B. Brick hammer
- C. Mortar boards
- D. Laboratory mortar
- E. Water pail
- F. Mason's line
- G. Line blocks
- H. Face bricks, approximately 204
- I. Established corner leads constructed in Job Sheet #4 and/or #5

II. Procedure

- A. Secure line with line blocks

(NOTE: Line should be pulled tight so it will not sag. See Figure 1.)

FIGURE 1



JOB SHEET #7

- B. Position mortar board close to wall
- C. Secure mortar and place on mortar board
- D. Lay first course of brick

1. Pick up enough mortar for one brick (Figure 2)

(NOTE: Keep ends of brick with bond marks on the floor.)

FIGURE 2



2. Place mortar next to last brick in lead on the left on course one

(NOTE: You may start at either end to lay to a line.)

3. Pick up brick and position it by taking only enough mortar on the end of the brick to shove a full head joint

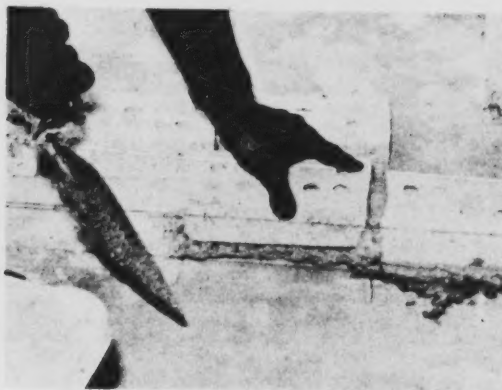
4. Apply pressure to top of brick to seat to a 3/8" bed joint

(NOTE: Edge of brick should be level with line and so you can see daylight between face of brick and line.)

JOB SHEET #7

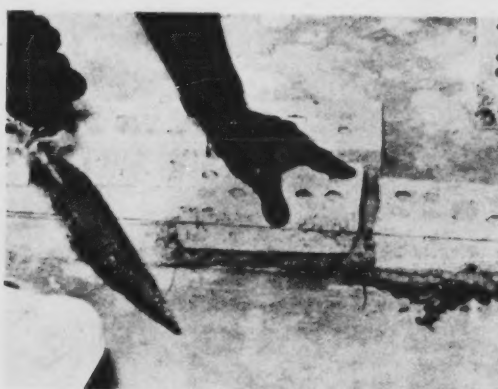
5. Cut mortar from sides of bed and head joints and return to mortar board (Figure 3)

FIGURE 3



6. Pick up enough mortar for one brick
7. Place mortar next to previously laid brick
8. Pick up brick and position it by taking only enough mortar on the end of the brick to shove a full head joint
9. Apply pressure to top of brick to seat to $\frac{3}{8}$ " bed joint
(NOTE: Check levelness with line and make sure you can see daylight between brick and line.)
10. Cut the mortar from both sides of head and bed joints and return to mortar board (Figure 4)

FIGURE 4



JOB SHEET #7

11. Continue picking up mortar and brick and laying to the line for three more brick (Figures 5a and 5b)

FIGURE 5a



FIGURE 5b



E. Lay closure brick

1. Pick up brick
2. Butter both ends of brick to be laid and both ends of brick already laid (Figures 6a and 6b)

FIGURE 6a

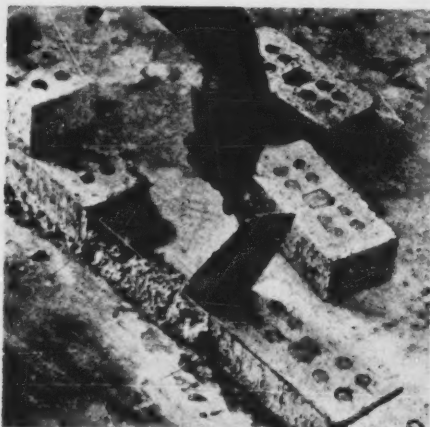


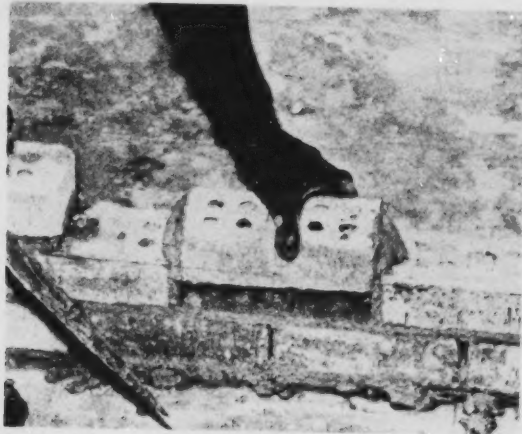
FIGURE 6b



JOB SHEET #7

3. Position brick into opening by pressing down firmly with fingers, keeping brick so that you can see daylight between line and face of brick (Figure 7)

FIGURE 7



4. Cut excess mortar from head and bed joints and return to mortar board
 5. Raise line for second course
- F. Lay second course of brick

(NOTE: When laying second course, be sure to keep half bond with first course laid.)

1. Pick up enough mortar for one brick
2. Place mortar next to last brick on lead on the right
3. Pick up brick and position it by taking only enough mortar to shove a full head joint
4. Apply pressure to top of brick to seat the bed joint to $\frac{3}{8}$ "

JOB SHEET #7

5. Cut excess mortar from both sides of head and bed joints (Figure 8)

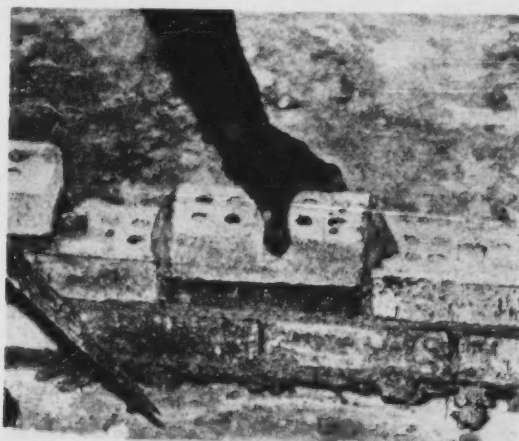
FIGURE 8



6. Continue to pick mortar and lay brick to the line for five more bricks or until you come to the last brick or closure (Figure 9)

(NOTE: Be sure to check levelness with line and alignment with course below.)

FIGURE 9



JOB SHEET #7

7. Lay closure brick on course two
 - a. Pick up brick
 - b. Butter both ends of brick to be laid and both ends of brick already laid
 - c. Place enough mortar for one brick
 - d. Position brick by pressing down firmly with fingers until top of brick is level with line and you can see daylight between face of brick and line
 - e. Cut mortar from both sides of head and bed joints and return to mortar board
8. Raise line for third course of brick (Figure 10)

FIGURE 10



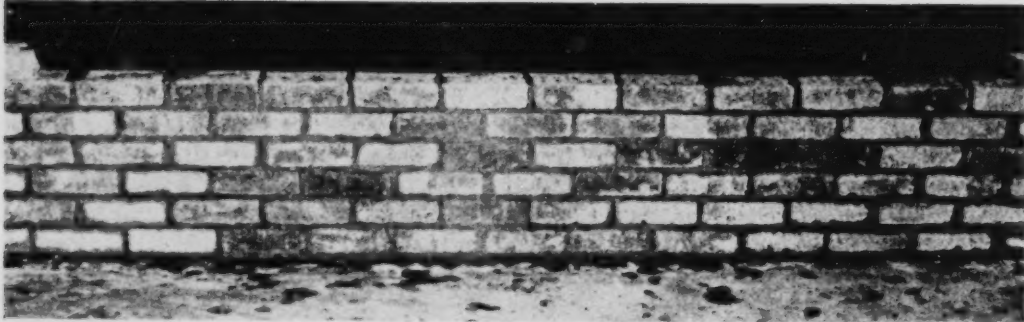
- G. Continue process of picking up mortar and brick and lay the remaining four courses using the procedures outlined
 1. Keep head and bed joints solid
 2. Sight end of brick with end of brick on course below to assure a plumb bond
 3. Check levelness with line

JOB SHEET #7

H. Check with instructor for evaluation

(NOTE: The finished wall should look like the one in Figure 11.)

FIGURE 11



SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #8-BUILD 90° BLOCK LEADS

(NOTE: This job sheet should be used by second-year students.)

- I. Tools and materials
 - A. Trowel
 - B. Brick hammer
 - C. Steel tape, 50' or 100'
 - D. Mortar boards
 - E. Laboratory mortar
 - F. Pail, 5 gallon
 - G. Mason's line
 - H. Line blocks
 - I. Soft brush
 - J. Framing square
 - K. Rule, 6'
 - L. Story pole
 - M. 8" block, approximately 74
 - N. Masonry saw
 - O. Heavy duty marking pencil

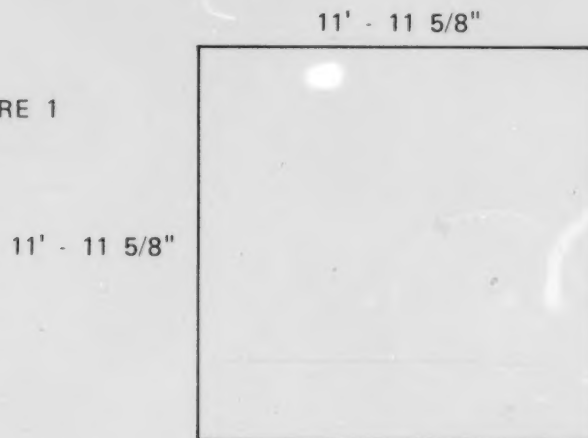
JOB SHEET #8

II. Procedure

(NOTE: Instructor should designate starting point.)

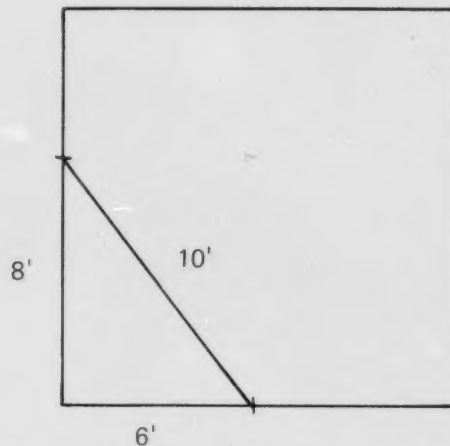
A. Chalk wall lines on floor (Figure 1)

FIGURE 1



B. Check squareness of chalk lines using the 6' - 8' - 10' method with steel tape (Figure 2)

FIGURE 2

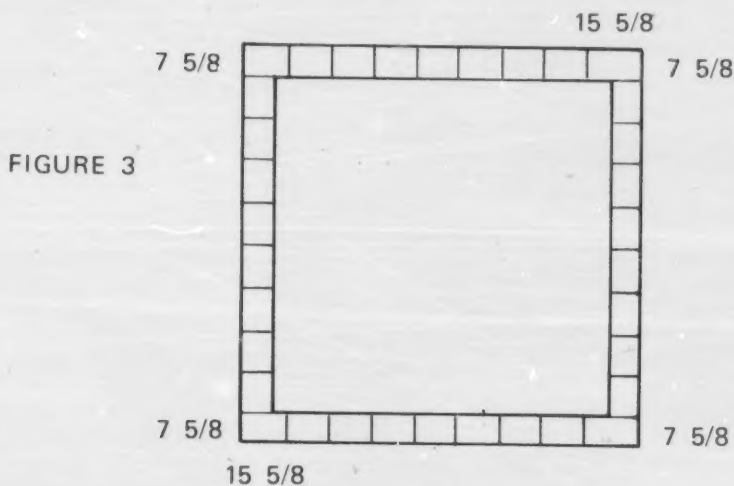


C. Check with instructor for evaluation

JOB SHEET #8

- D. Lay out block bond using the steel tape

(NOTE: An 11' - 11 5/8" wall will require nine blocks. See Figure 3.)



- E. Use steel tape to mark on floor 15 5/8" for first block and 7 5/8" on return or end of block (Figures 4a and 4b)

FIGURE 4a



FIGURE 4b

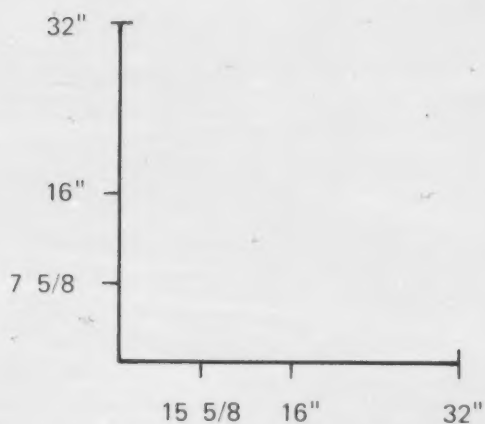


1. Start measuring for block bond at end of 15 5/8" mark on floor, marking every 16" for block bond

JOB SHEET #8

2. Mark every 16" on return wall starting at 7 5/8" mark (Figure 5)

FIGURE 5

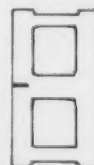


- F. Set up a deadman at the four corners for starting lead or laying first course of block; mark the course height on the deadman (Figure 6)

FIGURE 6



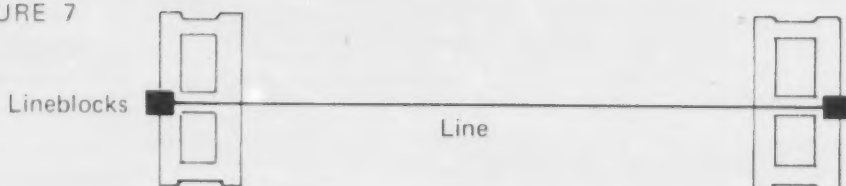
Course Height



Course Height

- G. Secure line using line blocks (Figure 7)

FIGURE 7



JOB SHEET #8

- H. Plumb from chalk line on floor with framing square and adjust deadman so that line will be plumb with chalk line (Figure 8)

(NOTE: This procedure can also be done using a level.)

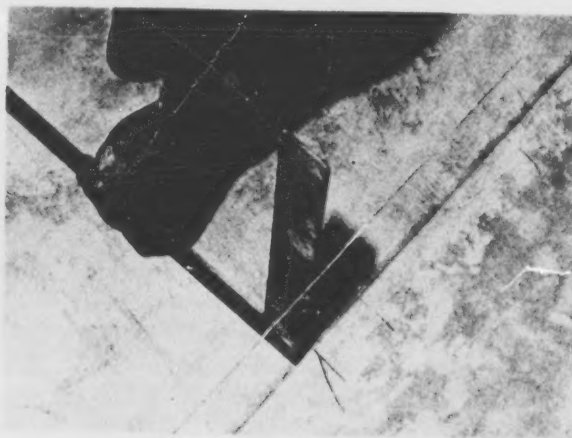


FIGURE 8

- I. Start first course lead
1. Spread mortar for three blocks, keeping mortar about $\frac{3}{4}$ " in thickness
 2. Pick up block with both hands and place it gently on mortar bed

(NOTE: In some areas blocks are picked up with one hand.)

JOB SHEET #8

3. Apply pressure with hand, keeping block with top of line and so you can see daylight between face of block and line; make sure bottom of block is with chalk lines on floor

(NOTE: Remember to cut off mortar at the head joints and bed joints. See Figure 9.)

FIGURE 9



- J. Stand two blocks on end and butter the vertical shells (Figure 10)

FIGURE 10



- K. Place blocks gently on mortar bed, keeping a $\frac{3}{8}$ " head joint and end of block with bond marks on floor and top of block with top of line

JOB SHEET #8

- L. Level the blocks just laid with 4' level; check the face of blocks for plumb, range, and straight edge (Figures 11a, 11b, and 11c)

FIGURE 11a

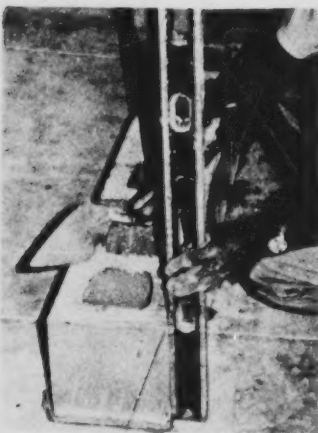


FIGURE 11b

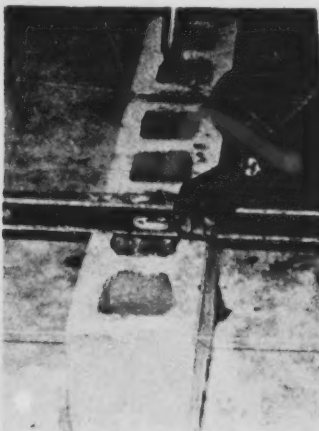
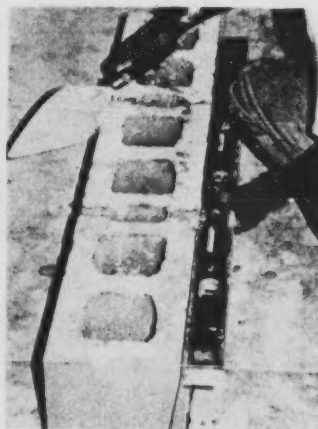


FIGURE 11c



- M. Spread mortar for two blocks at return of lead using the same procedures that were used for the two previous blocks
- N. Proceed to lay out the three remaining leads using the same procedures for laying out leads

(NOTE: Be sure to keep vertical shell filled solid. Keep block level, plumb, and on course height and so that you can see daylight between face of block and line.)

- O. Remove lines and joint off if needed, using a round jointer slightly larger than mortar joints

JOB SHEET #8

- P. Start second block course on lead by placing mortar on face shells for two blocks keeping blocks level, plumb, and on course height (Figures 12a and 12b)

FIGURE 12a



FIGURE 12b



- Q. Continue building lead to a height of five courses of 40" (Figure 13)

(NOTE: Remember to range block with level. Keep block level and plumb and on course height using story pole. Joint with round jointer if needed. Leads are one of the most important parts in masonry construction.)

FIGURE 13



- R. Check with instructor for evaluation before you start the three remaining leads
- S. Keep mortar well tempered

SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

JOB SHEET #9--LAY 8" BLOCK TO ESTABLISHED LEADS

(NOTE: First-year students should use leads constructed by second-year students.)

- I. Tools and materials
 - A. Trowel
 - B. Brick hammer
 - C. Mortar boards
 - D. Steel tape, 50' or 100'
 - E. Laboratory mortar
 - F. Pail, 5 gallon
 - G. Mason's line
 - H. Line blocks
 - I. Soft brush
 - J. Rule, 6'
 - K. 8" block, approximately 96
 - L. Masonry saw
 - M. Heavy duty marking pencil

JOB SHEET #9

II. Procedure

- A. Secure line for first course using line blocks; make sure line is tight and has no sag (Figure 1)

(NOTE: Use line pins or line holders if no corners are available.)

FIGURE 1



- B. Spread mortar for three blocks, keeping mortar about $\frac{3}{4}$ " thick
- C. Stand two blocks on end and butter the vertical shells (Figures 2a and 2b)

FIGURE 2a



FIGURE 2b



JOB SHEET #9

- D. Pick up block and place gently on mortar bed, keeping end of block with dry bond marks on floor
- E. Apply pressure with hand, keeping top of block with top of line and bottom face of block with chalk line on floor

(NOTE: Make sure you can see daylight between top of block and line.)

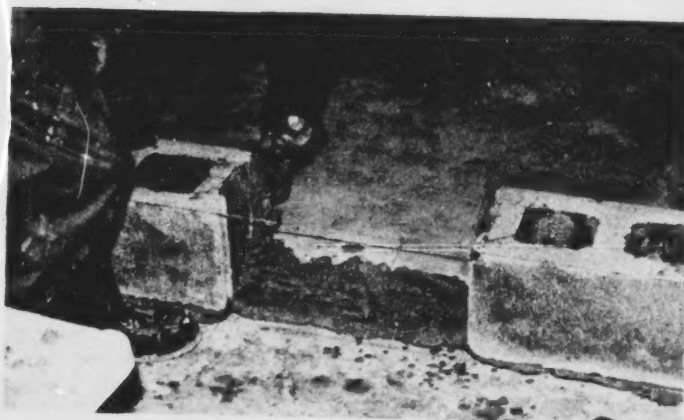
- F. Place second block using the same procedures used for previous block

(NOTE: Remember to cut off mortar at the vertical joints and bed joints.)

- G. Lay closure block or the last block to be laid to the line

- 1. Butter the vertical shells at both ends of the blocks laid to the line and butter the vertical shells at both ends of the block to be laid (Figure 3)

FIGURE 3

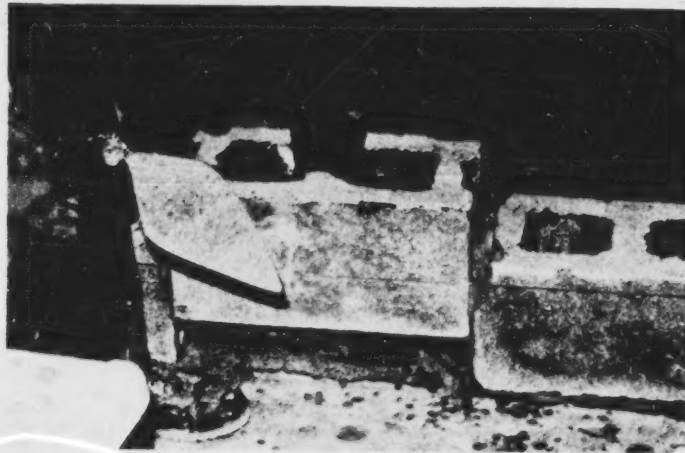


JOB SHEET #9

2. Pick up block and place it carefully so that vertical mortar joints will not fall off; apply pressure to top of block so that top of block is with top of line

(NOTE: Level width of blocks just laid so that you will have perfect alignment on the inside as well as the outside. Check blocks that have been laid to make sure they are in perfect alignment with top of line and so you can see daylight between the face of the block and the line. The first course should be laid perfectly. See Figure 4.)

FIGURE 4



H. Place mortar on face shells for second course

1. Raise line blocks to second course, making sure line is with top of block on lead

(NOTE: Make sure line is tight and has no sag.)

2. Stand three blocks on end close to where they are going to be laid; butter the vertical shells
3. Pick up block and with a shoving motion place it gently on mortar bed keeping a 3/8" head joint
4. Apply pressure at top of block, keeping top of block with top of line and bottom face of block on the same plane with the top face of the course below

(NOTE: Be sure you can see daylight between top of block and line.)

JOB SHEET #9

- I. Continue laying block to the line making sure block is on half bond until you reach the closure block or the last block to be laid to the line (Figures 5a, 5b, and 5c)

FIGURE 5a



FIGURE 5b



FIGURE 5c



- J. Lay closure block using the same procedures that were used for laying closure block on the first course (Figures 6a and 6b)

FIGURE 6a



FIGURE 6b



(NOTE: Check the blocks laid to the line to make sure they are in perfect alignment.)

JOB SHEET #9

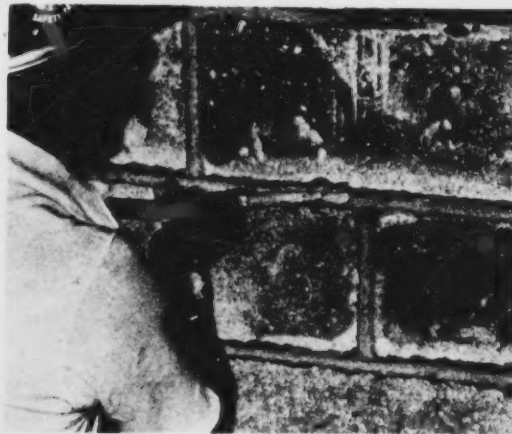
K. Continue placing mortar and raising the line to height of leads

1. Make sure line is tight and has no sag
2. Keep top of block with top of line and on the same plane with course below

(NOTE: Be sure you can see daylight between top of block and line.)

3. Remember to cut off mortar from head joints and bed joints on both sides of wall
4. Joint off block as needed with round jointer (Figure 7)

FIGURE 7



5. Keep mortar well tempered
6. Keep trowel and jointer clean

SPREADING MORTAR AND LAYING BRICK TO A LINE UNIT I

TEST

1. Match the terms on the right to the correct definitions. (Definitions are continued on the following page.)

- | | |
|--|---------------------|
| _____ a. Softening mortar by adding water and mixing | 1. Consistency |
| _____ b. Metal band attached around the end of the handle used to attach the handle to the shank of the trowel | 2. Spreading mortar |
| _____ c. Method of picking up mortar and brick at the same time | 3. Mortar |
| _____ d. Condition of the mortar that is of the same mixture and wetness | 4. Pick and dip |
| _____ e. Process of placing the mortar on the course that is being laid | 5. Story pole |
| _____ f. Piece of wood marked for course levels or course heights | 6. Ferrel |
| _____ g. Mortar which yields a plastic, workable, and trowelable substance | 7. Mortar body |
| _____ h. Combination of cement, lime, sand, and water | 8. Tempering mortar |
| _____ i. Section of a wall built up and racked back on successive courses | 9. Head joint |
| _____ j. Vertical mortar joint between ends of masonry units; often called <i>cross joint</i> | 10. Bed joint |
| _____ k. Tool used to establish or check corners and courses of masonry; also called a <i>deadman</i> | 11. Trig |
| _____ l. Horizontal layer of mortar on which a masonry unit is laid | 12. Lead |
| _____ m. Tool used to prevent line sag and to prevent movement from wind | 13. Mason's line |
| | 14. Range line |
| | 15. Corner pole |
| | 16. Jointer |
| | 17. Racking back |

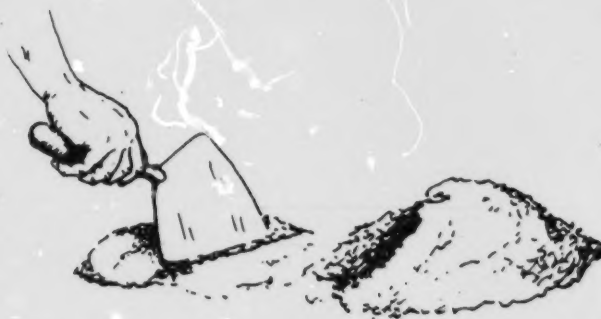
- _____ n. Line used to keep masonry units on true alignment from corner to corner
- _____ o. Method of stepping back successive courses of masonry
- _____ p. Nylon line used for keeping brick level, straight, and plumb
- _____ q. Tool used to form the joints in masonry work
2. Distinguish between the correct and incorrect ways of holding a trowel by placing an "X" in the blank which represents the correct method.



a. _____

b. _____

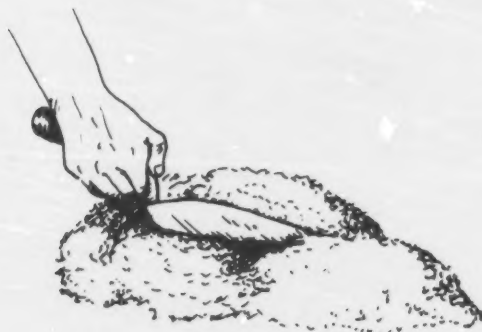
3. Identify the following methods of picking up mortar from the mortar board by writing the correct names in the blanks provided.



a. _____



b. _____



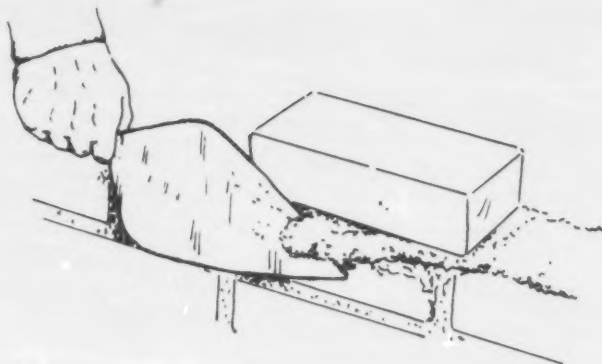
c. _____

4. Name two purposes of the mason's line.

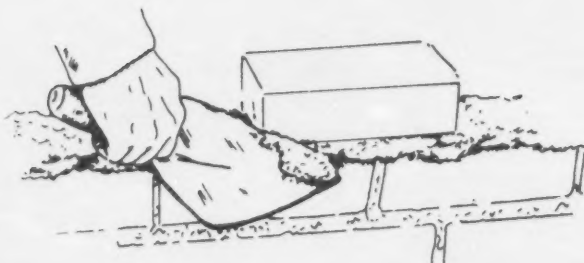
a.

b.

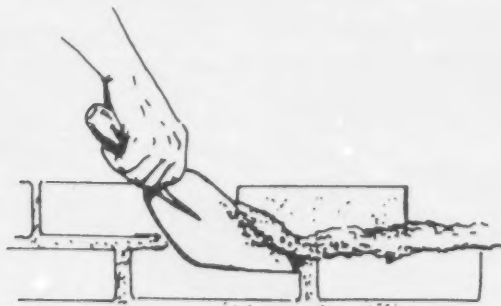
5. Identify the direction of the bricklayer's travel for placing mortar while laying brick.



a. _____



b. _____



c. _____

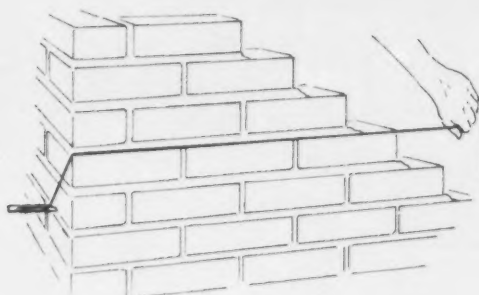
6. Name three factors to consider when placing mortar on brick.

a.

b.

c.

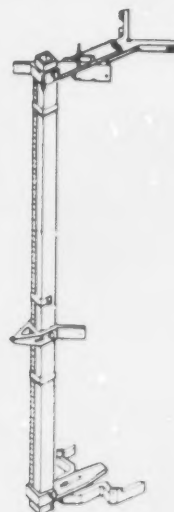
7. Identify the following methods of putting up the line.



a. _____



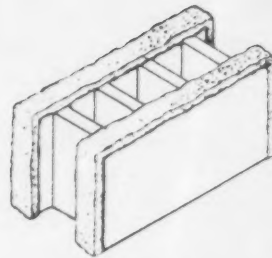
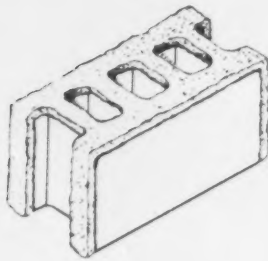
b. _____



c. _____

8. Discuss in a short paragraph the procedure for spotting the trig.

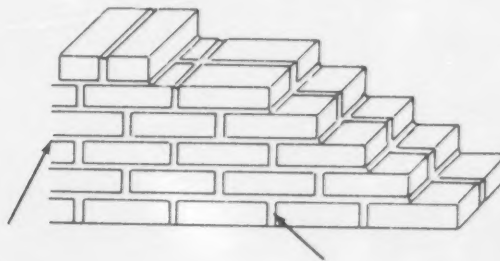
9. Identify the following types of bedding.



a. _____

b. _____

10. Label a head joint and a bed joint on the drawing below.



a. _____

b. _____

11. List the two purposes of racking brick.

a.

b.

12. State the two purposes of walling brick.

a.

b.

13. Demonstrate the ability to:
- a. Spread mortar on a 2 x 4 using the western method.
 - b. Spread mortar on a 2 x 4 using the eastern method.
 - c. Spread mortar on a 2 x 4 for block.
 - d. Build 90° brick leads using the western method.
 - e. Build 90° brick leads using the eastern method.
 - f. Lay brick to a line with established leads using the western method.
 - g. Lay brick to a line with established leads using the eastern method.
 - h. Build 90° block leads.
 - i. Lay 8" block to a line with established leads.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

SPREADING MORTAR AND LAYING BRICK TO A LINE
UNIT I

ANSWERS TO TEST

- | | | | | | | |
|----|----|---|----|----|----|----|
| 1. | a. | 8 | g. | 7 | m. | 11 |
| | b. | 6 | h. | 3 | n. | 14 |
| | c. | 4 | i. | 12 | o. | 17 |
| | d. | 1 | j. | 9 | p. | 13 |
| | e. | 2 | k. | 15 | q. | 16 |
| | f. | 5 | l. | 10 | | |
2. b
3. a. From the side
b. From the middle
c. From the top
4. a. Keep masonry walls in true alignment
b. Keep course straight, plumb, and level
5. a. Laying brick to your hand
b. Laying brick backhand or against hand
c. Laying brick overhand
6. a. Keep mortar well rounded on board
b. Keep mortar tempered
c. Keep trowel clean
7. a. Line pins
b. Line blocks
c. Corner pole

8. Discussion should include:
 - a. Spot brick for trig
 - b. Attach trig to line
 - c. Secure trig with dry brick
 - d. Sight the line
9.
 - a. Full mortar bedding
 - b. Face shell bedding
10.
 - a. Bed joint
 - b. Head joint
11.
 - a. Build a lead
 - b. Determine course height
12.
 - a. Save time
 - b. Save motion
13. Performance skills evaluated to the satisfaction of the instructor

WALL LAYOUT AND CONSTRUCTION UNIT II

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify methods of layout and discuss purposes of bonding, leads, and reinforced masonry. The student should also be able to lay out and construct a wall section with and without openings. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with wall layout to the correct definitions.
2. Discuss in a short paragraph the purposes of laying out brick bonds.
3. Identify methods of layout.
4. Discuss in a short paragraph the purposes of bonds.
5. Identify the types of bonds.
6. Distinguish between load-bearing and nonload-bearing walls.
7. State the purpose of through-wall bonding.
8. Identify types of through-wall bonding.
9. State the purposes of grouting.
10. List types of reinforcement.
11. Discuss in a short paragraph the purposes of flashing.
12. Identify the types of flashing.
13. Discuss in a short paragraph the purposes of leads.
14. Identify types of leads.
15. Discuss in a short paragraph the purposes of tooling.
16. Identify the types of tooling.

17. Discuss in a short paragraph the purposes of wall protection.
18. Name methods used in wall protection.
19. Discuss in a short paragraph the purposes of reinforced masonry.
20. Name types of reinforced masonry.
21. Demonstrate the ability to:
 - a. Lay out and construct a section of wall with a joint reinforcement.
 - b. Lay out and construct a section of wall with openings and joint reinforcement.

WALL LAYOUT AND CONSTRUCTION
UNIT II

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined on the job sheets.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Methods of Layout
 - 2. TM 2--Types of Bonds
 - 3. TM 3--Types of Bonds (Continued)

4. TM 4--Types of Through-Wall Bonding
5. TM 5--Types of Flashing
6. TM 6--Types of Leads
7. TM 7--Types of Tooling
8. TM 8--Methods of Wall Protection

D. Job sheets

1. Job Sheet #1--Lay Out and Construct a Section of Wall with a Joint Reinforcement
2. Job Sheet #2--Lay Out and Construct a Section of Wall with Openings and Joint Reinforcement

E. Test

F. Answers to test

II. References:

- A. Graham, Frank D. *Audels Masons and Builders Guide*. Vol. 1. Indianapolis: Theodore Audel and Co./Howard W. Sams and Co., Inc., 1961.
- B. Hendrix, Laborn J., and Patton, Bob. *Cement Mason's Curriculum*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1975.
- C. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.

WALL LAYOUT AND CONSTRUCTION
UNIT II

INFORMATION SHEET

I. Terms and definitions

- A. Layout-Procedure to establish wall lines, bonds, openings, elevations, and type of wall to be constructed
- B. Brick bond-Pattern to which bricks are laid
- C. Dry bonding-Method of determining brick bond by laying brick without mortar
- D. Load-bearing wall-Wall that supports the floors and roof of the building
- E. Nonload-bearing wall-Wall that has no structural tie to the building by allowing floors or roofs to bear their weight on it
- F. Through-wall bonding-Method of bonding or tying together the outer and inner walls
- G. Flashing-Sheet metal of special shapes and designs to be used at various sections of the wall for waterproofing
- H. Lead-Section of wall built in advance of the rest of the wall to determine wall lines and elevations
- I. Tooling-Process designed to weatherproof and beautify the mortar joint
- J. Wall protection-Method used to protect walls from damage during construction
- K. Reinforced masonry-Masonry wall built with a particular type designed pattern of steel reinforcement
- L. Scaffold-Temporary structure or platform to support workmen and material during construction
- M. Scaffold high-Specifies that the wall is built high enough and is ready for scaffold to be built so the wall can continue to be constructed
- N. Story pole-Length of 1" x 2" piece of wood at least 8' in length with brick coursing marked out on it along with elevation of all things occurring in a certain wall section

INFORMATION SHEET

- O. Lintel--Piece of steel used to receive masonry units over tops of doors and windows

(NOTE: In some instances concrete is used as a lintel.)

- P. Parging--Process of applying a layer of mortar to vertical face of masonry units

- Q. Keel--Engineer's crayon

- R. Wythe--Continuous section of masonry, one unit in thickness

- S. Grout--Thin mortar which will pour without separation of the ingredients

- T. Grouted masonry--Masonry in which the interior joints are filled in with grout as the work progresses

II. Purposes of laying out brick bonds

- A. Establish in place and mark the position of each brick of the first course to ensure a true bond
- B. Locate doors, windows, and other openings so that the bond can be regulated or fitted to dimensions called for on the blueprint

III. Methods of layout (Transparency 1)

- A. Dry bonding
- B. Steel tape bonding

IV. Purposes of bonds

- A. Add strength and rigidity to the wall
- B. Beautify through design and economy of design

V. Types of bonds (Transparencies 2 and 3)

- A. Running
- B. Flemish
- C. 1/3 running
- D. Common or full header
- E. English

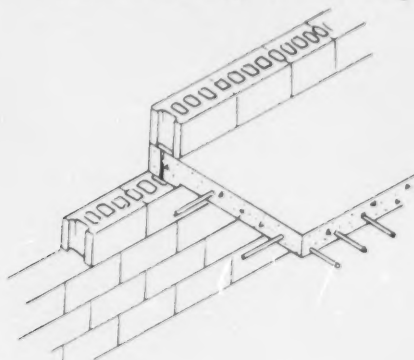
INFORMATION SHEET

- F. Stack
- G. Common or Flemish header
- H. English cross or Dutch
- I. Herringbone flat
- J. Herringbone regular
- K. Basket weave flat
- L. Basket weave on edge

VI. Walls

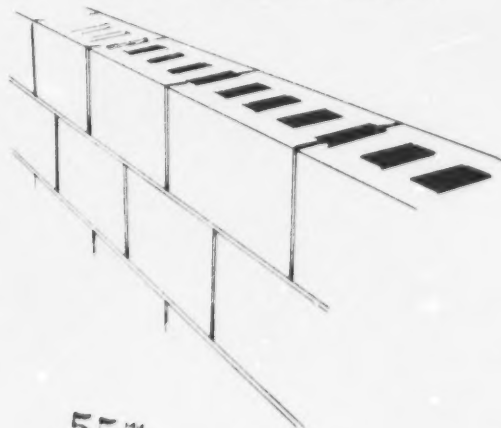
- A. Load-bearing

(NOTE: The wall supports not only its own weight but the weight of the floor above.)



- B. Nonload-bearing

(NOTE: The wall supports only its own weight.)



INFORMATION SHEET

VII. Purpose of through-wall bonding--Tie together outer and inner wythes

VIII. Types of through-wall bonding (Transparency 4)

- A. Header construction
- B. Joint reinforcement or heavy gauge ties
- C. Grouting and reinforcement

IX. Purposes of grouting

- A. Provide greater strength in walls
- B. Form a single unit of construction to resist forces

X. Types of reinforcement

- A. Low-lift grout
- B. High-lift grout
- C. Reinforcing steel
 - 1. Rods or bars
 - 2. Wire
 - 3. Wire screen
 - 4. Metal lathe

XI. Purposes of flashing

- A. Divert water
- B. Act as a sealant

XII. Types of flashing (Transparency 5)

- A. Through-wall
- B. Sill
- C. Window
- D. Door

INFORMATION SHEET

- E. Counter
- F. Raggle
- XIII. Purposes of leads
 - A. Establish wall elevation
 - B. Establish wall pattern
 - C. Act as guide for wall construction
- XIV. Types of leads (Transparency 6)
 - A. Outside corner
 - B. Angle or inside corner
 - C. Corner pole
- XV. Purposes of tooling
 - A. Seal and weatherproof mortar joints
 - B. Add design or ornamental value
- XVI. Types of tooling (Transparency 7)
 - A. Round or concave joint
 - B. V-joint
 - C. Beaded or convex joint
 - D. Struck joint
 - E. Raked joint
 - F. Flush joint
 - G. Weather joint
- XVII. Purposes of wall protection
 - A. Protect from water induction during construction
 - B. Protect from blowing down

INFORMATION SHEET

C. Protect from freezing

D. Protect from staining

XVIII. Methods of wall protection (Transparency 8)

A. Cover wall

B. Brace wall

(NOTE: During cold weather the wall should be enclosed and adequate heat applied.)

XIX. Purposes of reinforced masonry

A. Develop greater wall strength

B. Create resistance to tensile, shearing, and compression stresses

XX. Types of reinforced masonry

A. Reinforced brick masonry (RBM method)

B. High lift grouted reinforced brick masonry

C. Reinforced masonry retaining walls

D. Reinforced brick and tile lintels

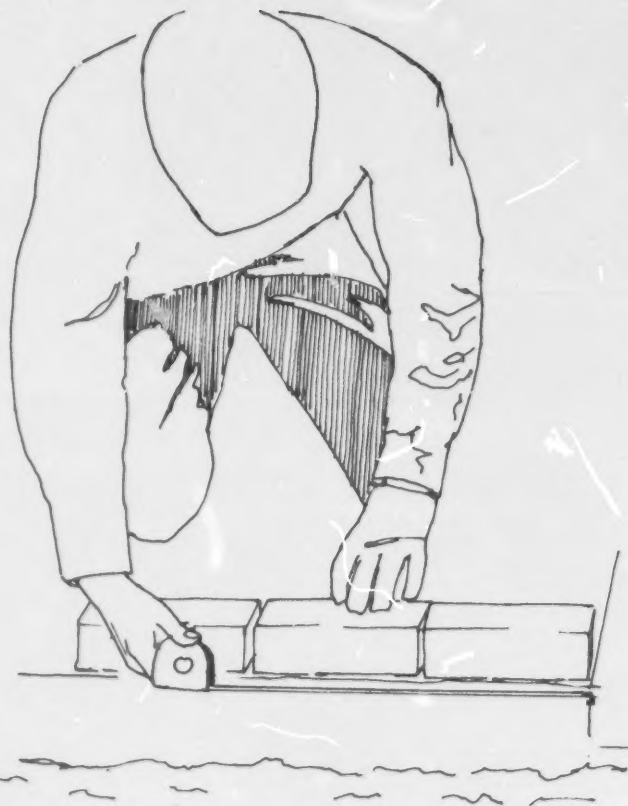
E. Reinforced brick masonry columns and pilasters

F. Reinforced brick masonry swimming pools

Methods of Layout

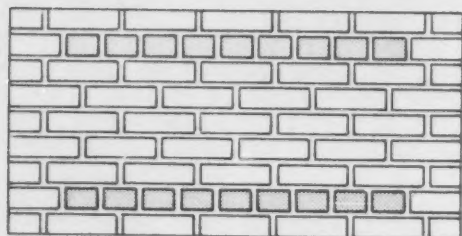


Dry Bonding

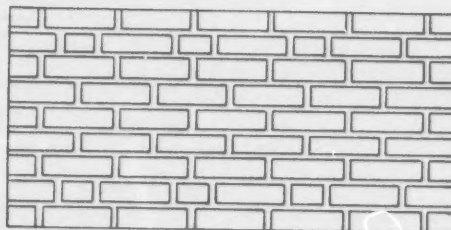


Steel Tape Bonding

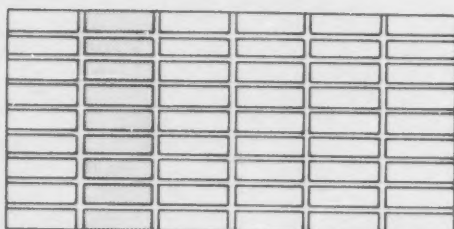
Types of Bonds



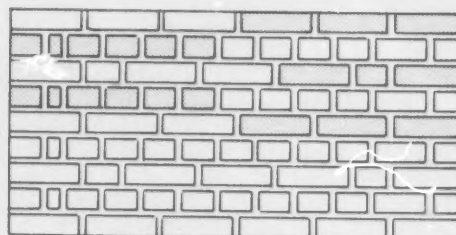
Common or Full Header



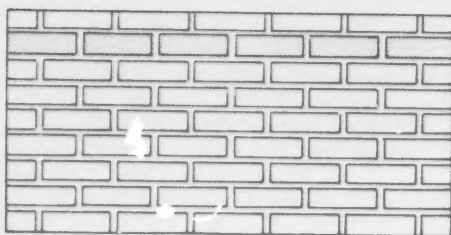
Common or Flemish Header



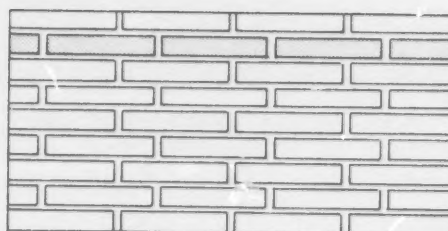
Stack



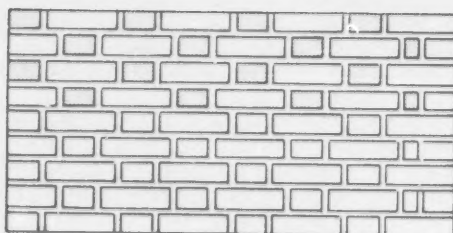
English Cross or Dutch



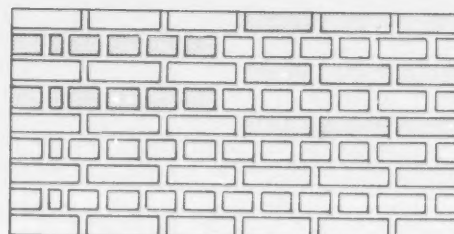
Running



1/3 Running



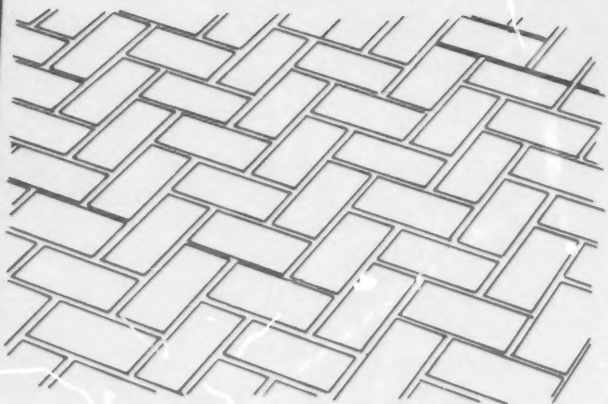
Flemish



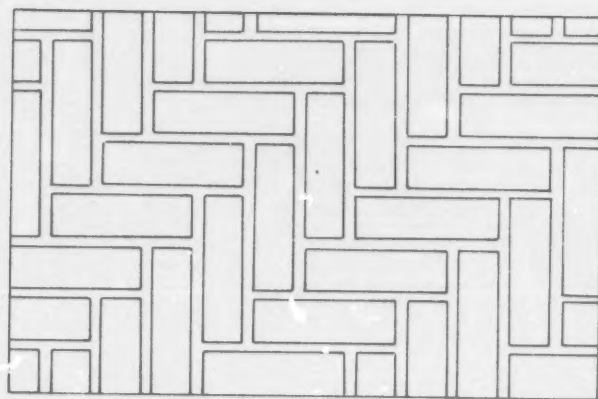
English

Types of Bonds

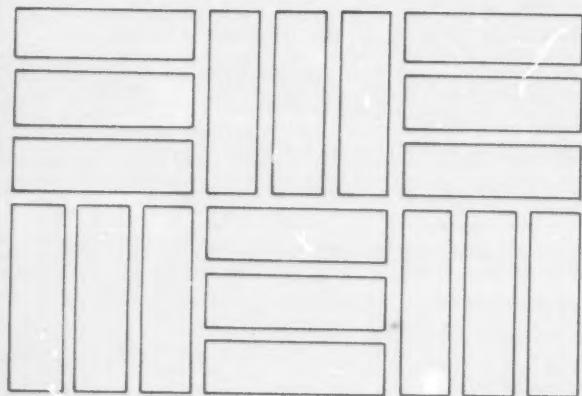
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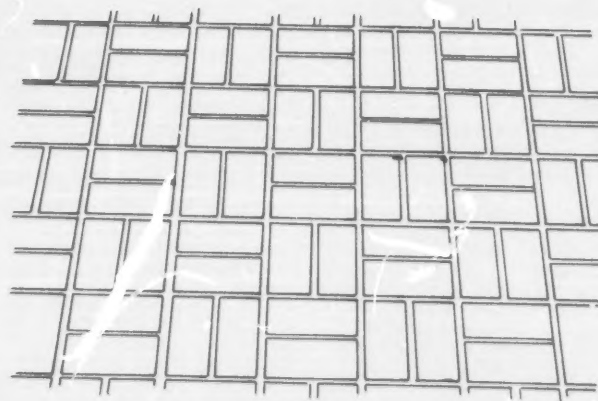
Herringbone Flat



Herringbone Regular

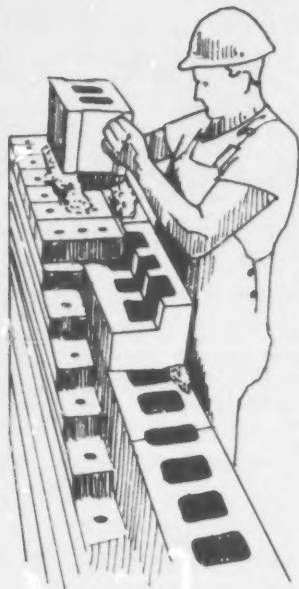


Basket Weave On Edge

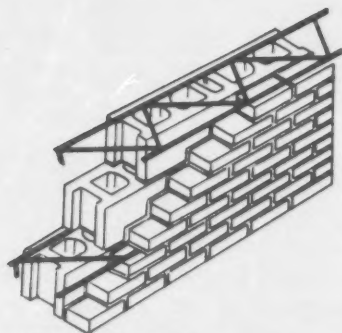


Basket Weave Flat

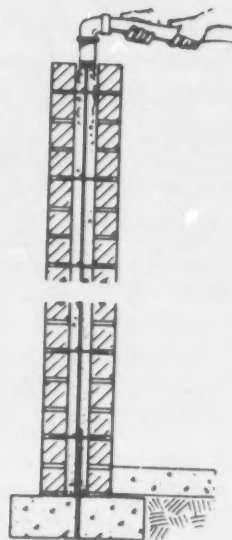
Through-Wall Bonding



Header Construction

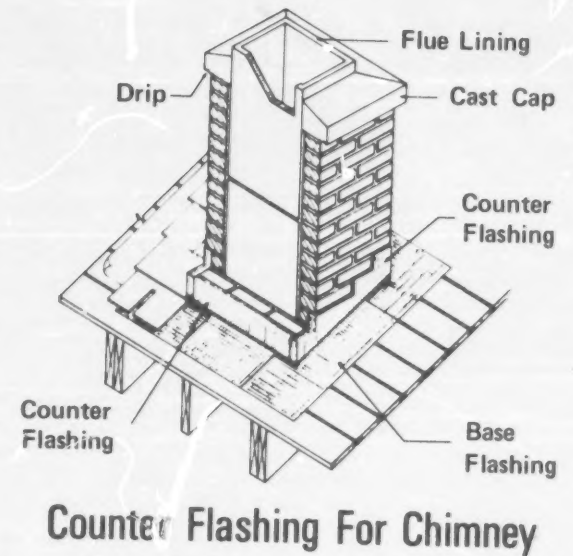
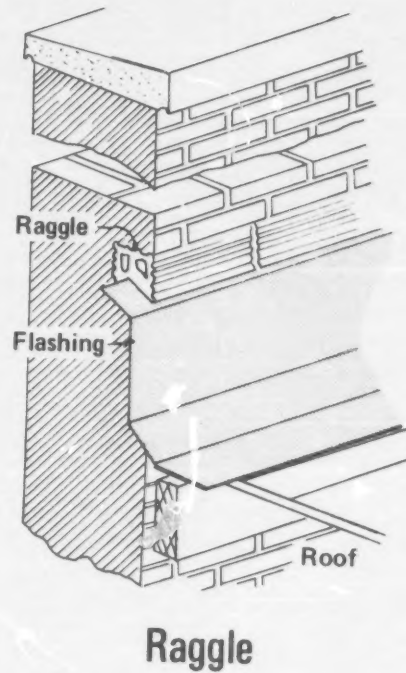
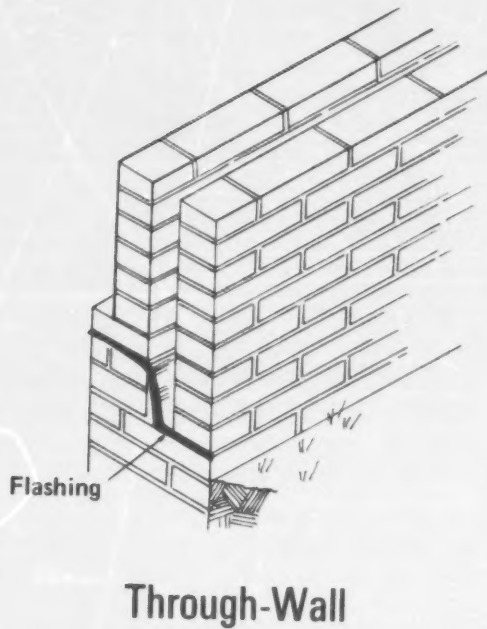
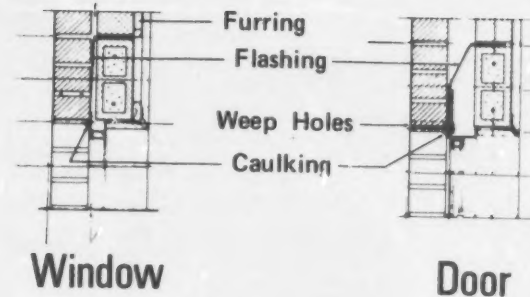
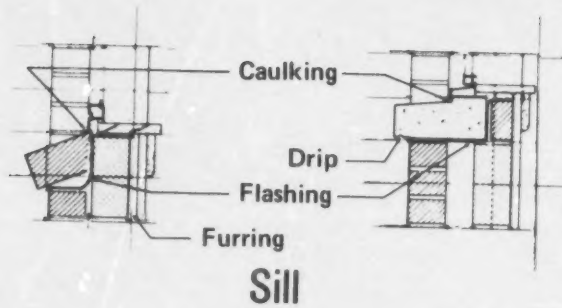


Joint Reinforcement
or Heavy
Gauge Ties

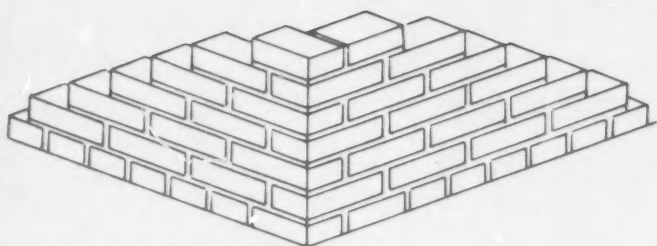


Grouting and Reinforcement

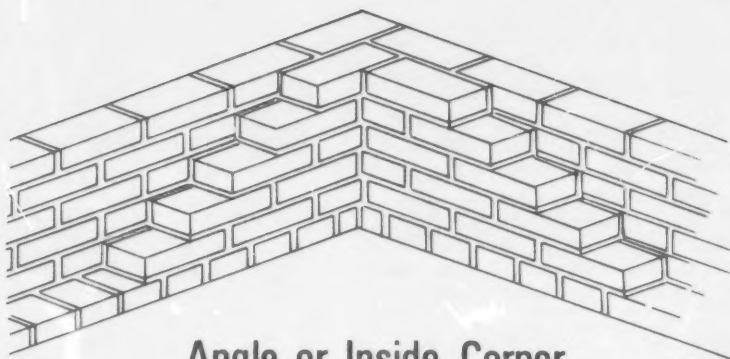
Types of Flashing



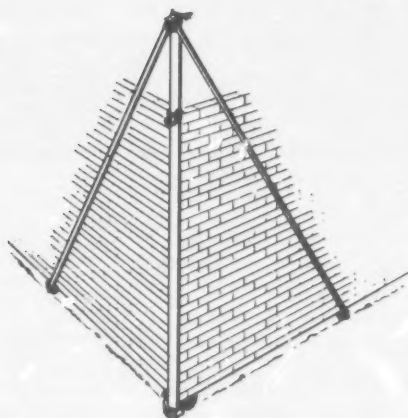
Types of Leads



Outside Corner

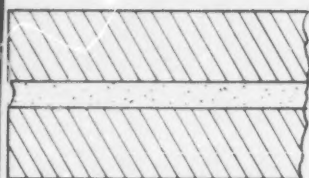


Angle or Inside Corner

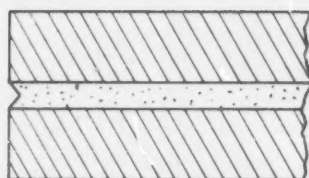


Corner Pole

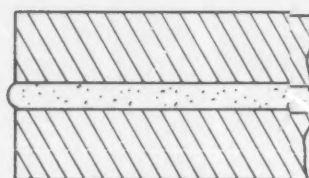
Types of Tooling



Round or
Concave Joint



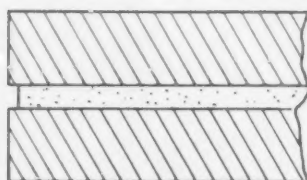
V-Joint



Beaded or
Convex Joint



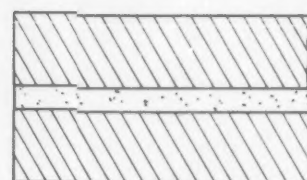
Struck Joint



Raked Joint

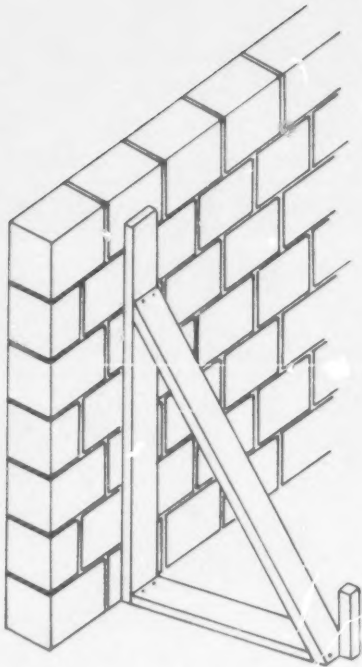


Weather Joint

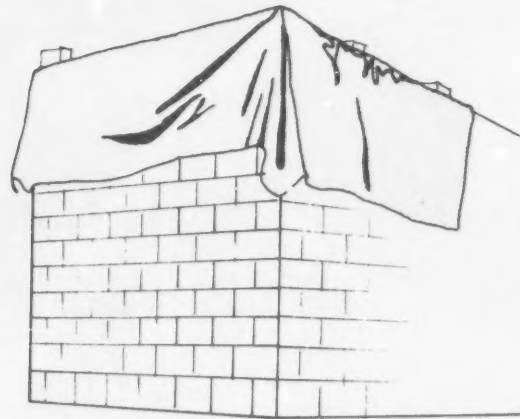


Flush Joint

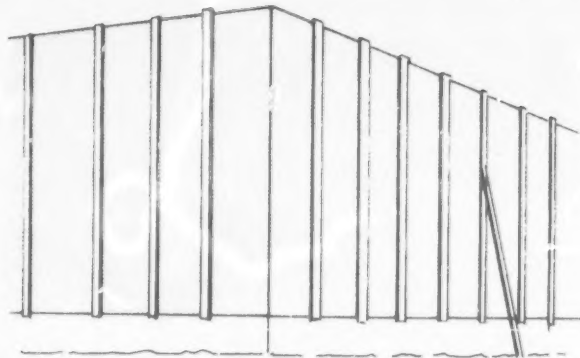
Methods of Wall Protection



**Bracing Wall to Protect
From Blowing Down**



**Covering Wall to Protect From
Water Induction and From Staining**



Covering Wall to Protect From Freezing

WALL LAYOUT AND CONSTRUCTION
UNIT IIJOB SHEET #1--LAY OUT AND CONSTRUCT A SECTION OF WALL
WITH A JOINT REINFORCEMENT

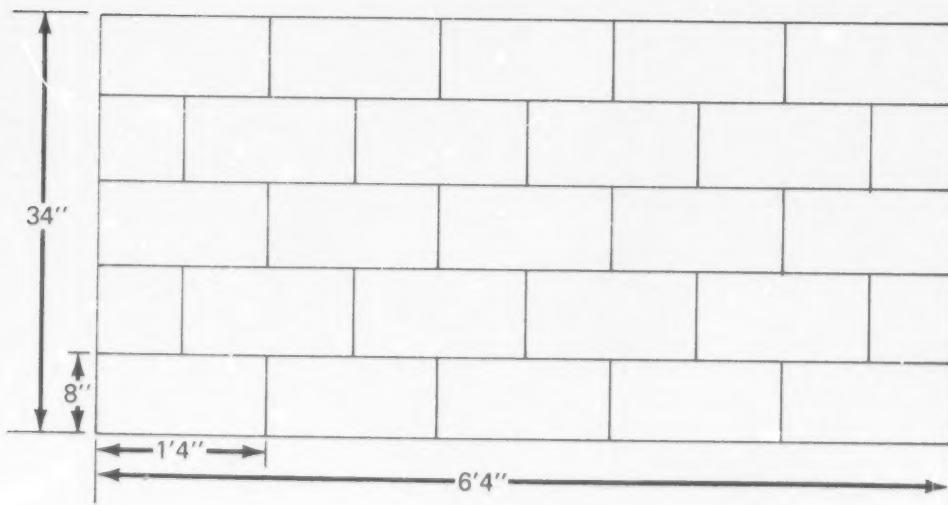
I. Tools and materials

- A. Steel tape, 50' or 100'
- B. Bricklayer's modular rule
- C. Trowel
- D. Framing square
- E. Story pole
- F. Hammer
- G. Round jointer
- H. Level, 4'
- I. Chalk line
- J. Nylon line
- K. Heavy duty marking pencil
- L. Keel (marking crayon)
- M. Line pins, trig, and line blocks
- N. Plumb bob
- O. Brick set
- P. Masonry saw with dry blade
- Q. Face brick, 150
- R. Concrete block 8" x 8" x 16" square end, 23
- S. Half concrete block 8" x 8" x 8" square end, 4
- T. Joint reinforcement for 12" wall
- U. Laboratory mortar
- V. Water pail
- W. Bolt cutter

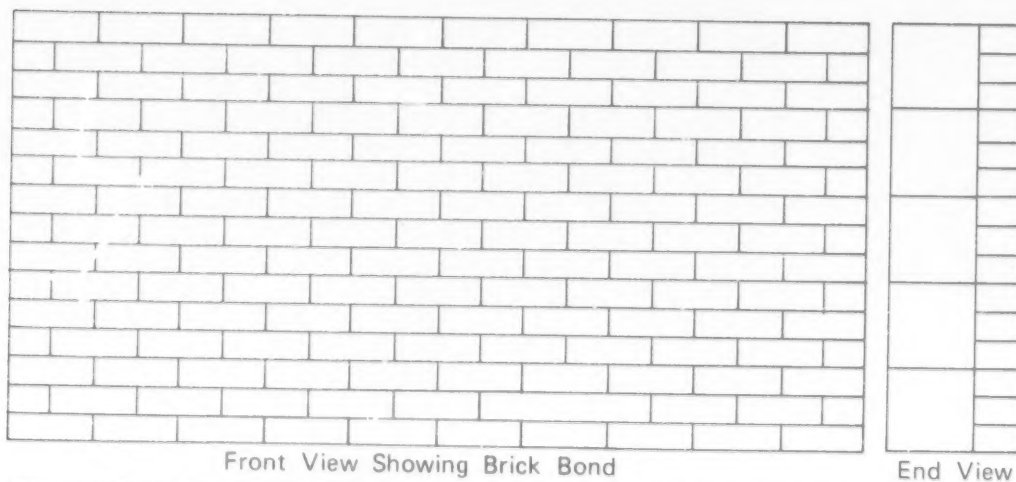
JOB SHEET #1

II. Procedure

(NOTE: Construct the wall section using the plan below and the procedure outlined on the following pages.)

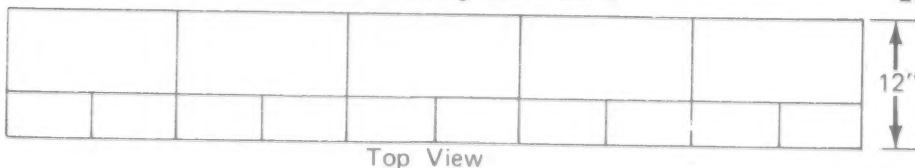


Front View Showing Block Bond



Front View Showing Brick Bond

End View



Top View

JOB SHEET #1

A. First course block

(NOTE: Some specifications call for the brick wall to be built first.)

1. Locate known reference points

(NOTE: Instructor in a laboratory situation should designate points for reference or starting points.)

2. Snap a chalk line from point A to point B (Figure 1)

(NOTE: This will establish the exterior wall line.)

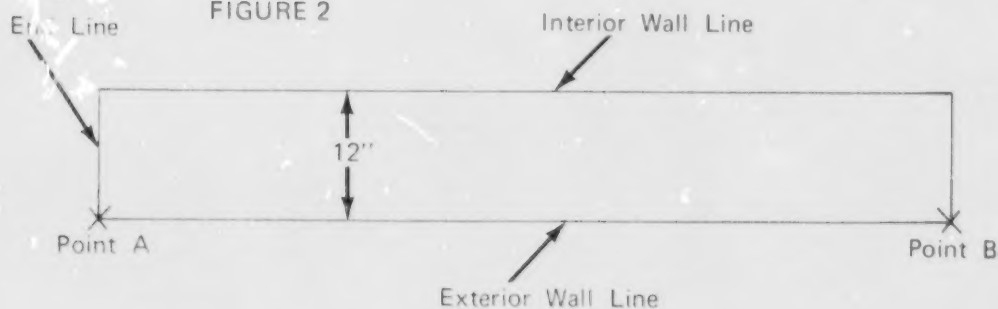
FIGURE 1



3. Establish the interior wall line by measuring a distance of 12" from the exterior wall line (Figure 2)

(NOTE: This line should parallel the exterior wall line.)

FIGURE 2



JOB SHEET #1

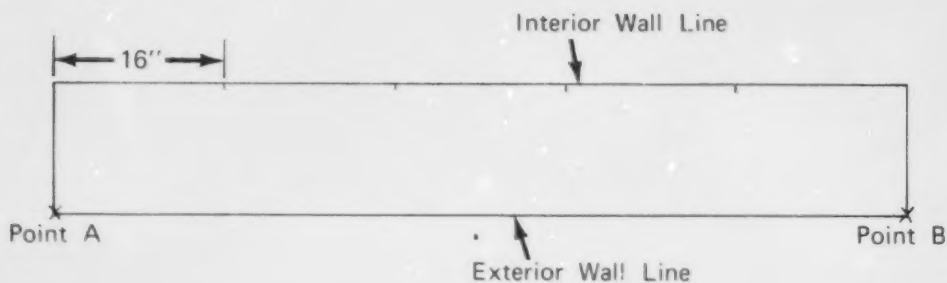
4. Square end lines between interior and exterior wall lines at point A and point B

(NOTE: See Figure 2.)

5. Measure and mark every 16" on the interior wall line with the steel tape (Figure 3)

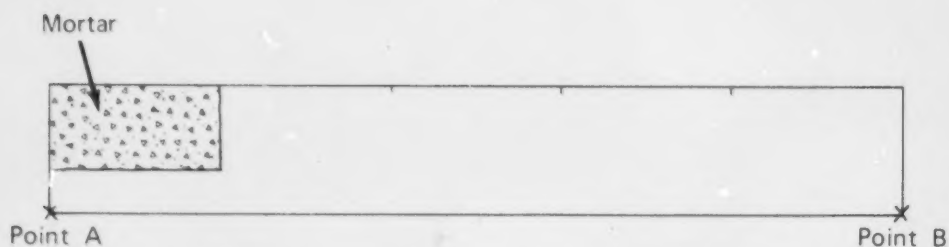
(NOTE: This will mark the block bond.)

FIGURE 3



6. Place mortar for first block at point A end of the wall (Figure 4)

FIGURE 4



7. Pick up block and gently position it, keeping the block straight with interior wall line and end line
8. Set block at point B

(NOTE: Check each course height with story pole.)

JOB SHEET #1

- B. Lay first course of block to the line

(NOTE: The first course of the wall is very critical. The blocks should be in proper alignment with wall line and plumb, level, and square.)

- C. Lay second course of block
D. Remove line
E. Parge the exterior face of the concrete blocks

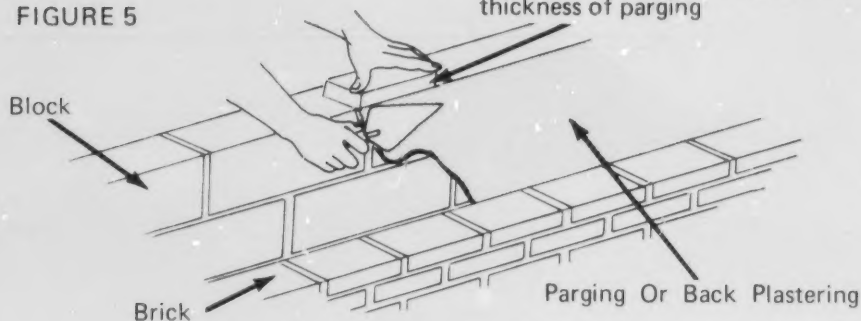
(NOTE: The exterior face is the face next to the brick.)

1. Pick up mortar with back of trowel
2. Apply a coat of mortar to the face of the block starting at the bottom

(NOTE: Hold brick at top of block to be parged to get desired thickness. See Figure 5.)

Brick guide on top of last course of face wythe for gauge to get desired thickness of parging

FIGURE 5



3. Remove any mortar dropped on the floor during parging

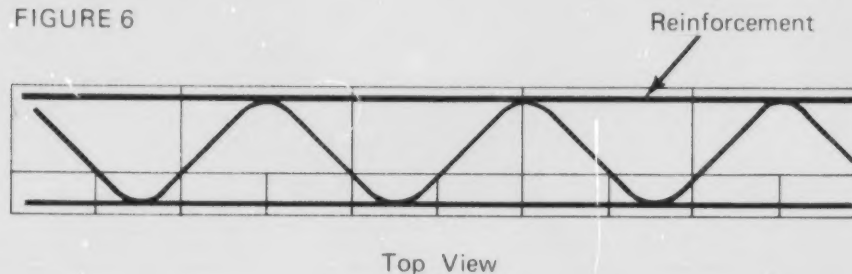
- F. Lay out a dry bond for first course of brick
G. Mark end of each brick
H. Remove dry bond
I. Lay first course of brick
J. Build leads for five more courses of brick
K. Lay the five courses of brick to the line

(NOTE: Make sure sixth course height is same as second course of block.)

JOB SHEET #1

- L. Joint the vertical joints
- M. Joint the horizontal joints
- N. Brush the wall after jointing to remove mortar burrs
- O. Select joint reinforcement for a 12" wall with brick and 8" block interior
- P. Cut reinforcement 1" shorter than length of wall using bolt cutters
- Q. Place reinforcement on top of wall, keeping it centered on wall (Figure 6)

FIGURE 6



(NOTE: By keeping reinforcement centered on wall, it insures a better mortar bed joint. The joint reinforcement should be lapped at least 6".)

- R. Build two course leads of block at points A and B
- S. Lay block to line for two courses
- T. Parge the face of the block
- U. Build six course leads of brick at points A and B
- V. Lay six courses of brick to line
- W. Joint if necessary
- X. Place reinforcement on top of wall
- Y. Lay one more course of block
- Z. Lay three more courses of brick
- AA. Joint all vertical and horizontal joints

WALL LAYOUT AND CONSTRUCTION
UNIT IIJOB SHEET #2--LAY OUT AND CONSTRUCT A SECTION OF WALL
WITH OPENINGS AND JOINT REINFORCEMENT

I. Tools and materials

- A. Steel tape, 50' or 100'
- B. Bricklayer's modular rule
- C. Trowel
- D. Framing square
- E. Story pole
- F. Hammer
- G. Round jointer
- H. Level, 4'
- I. Dusting brush
- J. Chalk line
- K. Nylon line
- L. Heavy duty marking pencil or keel (marking crayon)
- M. Line pins
- N. Trig
- O. Line blocks
- P. Plumb bob
- Q. Brick set
- R. Face brick
- S. Concrete block, 8" x 8" x 16" square end
- T. Concrete block holes, 8" x 8" square end
- U. Joint reinforcement for 12" wall
- V. Laboratory mortar

JOB SHEET #2

W. Water pail

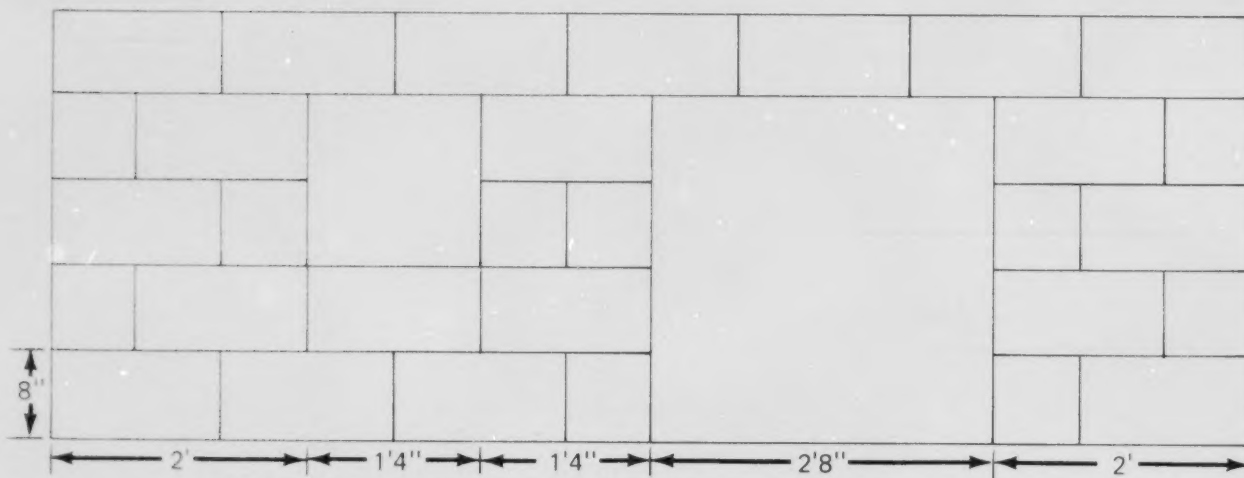
X. Bolt cutters

Y. Steel lintels, 3' 4" x 3 1/2" x 3 1/2" x 3/8" (3)

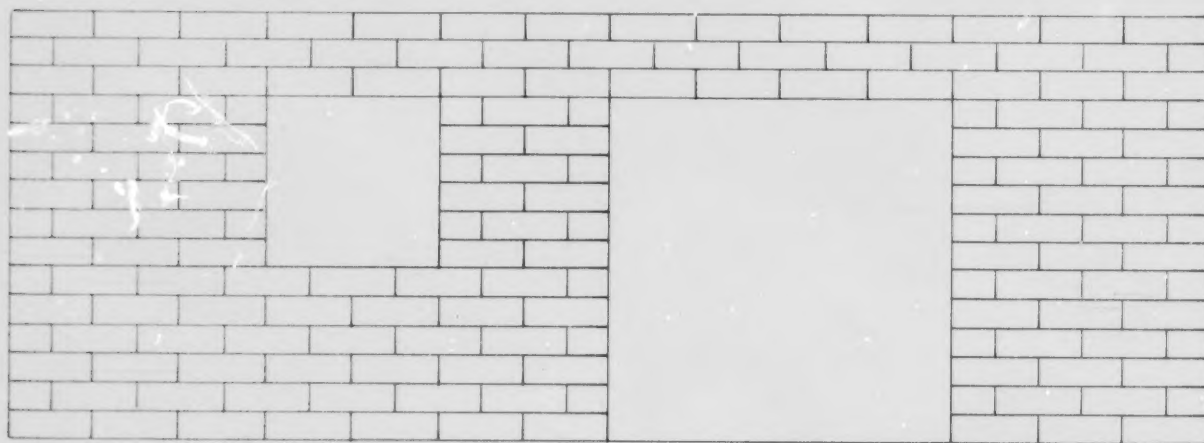
Z. Steel lintels, 2' 4" x 3 1/2" x 3 1/2" x 3/8" (3)

II. Procedure

(NOTE: Construct the wall section using the plan below and the procedure outlined on the following pages.)



Front View Showing Block Bond With Door and Window Openings



Front View Showing Brick Bond With Door and Window Openings

JOB SHEET #2

A. Establish wall lines

1. Locate known reference points

(NOTE: Instructor in a laboratory setting should designate point of reference or starting point.)

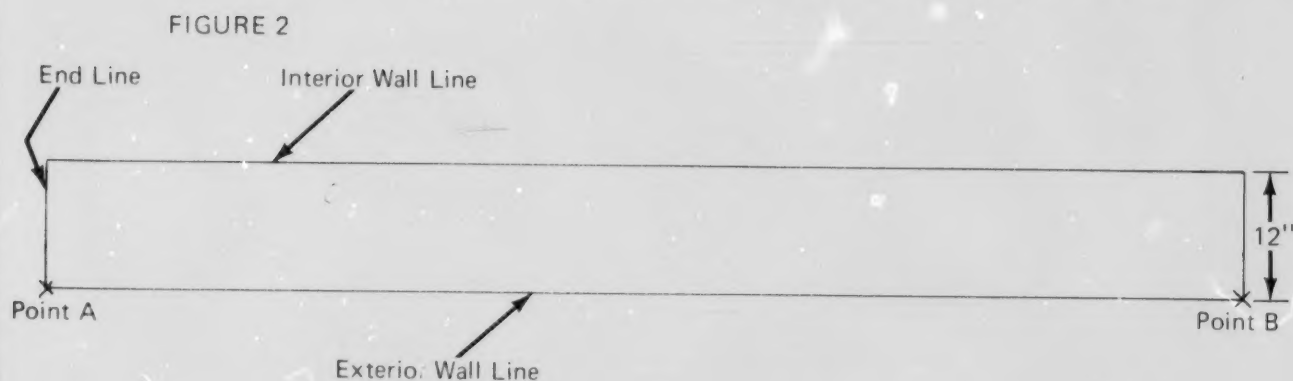
2. Snap a chalk line from point A to point B (Figure 1)

(NOTE: This will establish the exterior wall line.)



3. Establish the interior wall line by measuring a distance of 12" from the exterior wall line (Figure 2)

(NOTE: This line should be parallel to the exterior wall line.)



4. Square end lines
5. Check wall lines for dimension accuracy

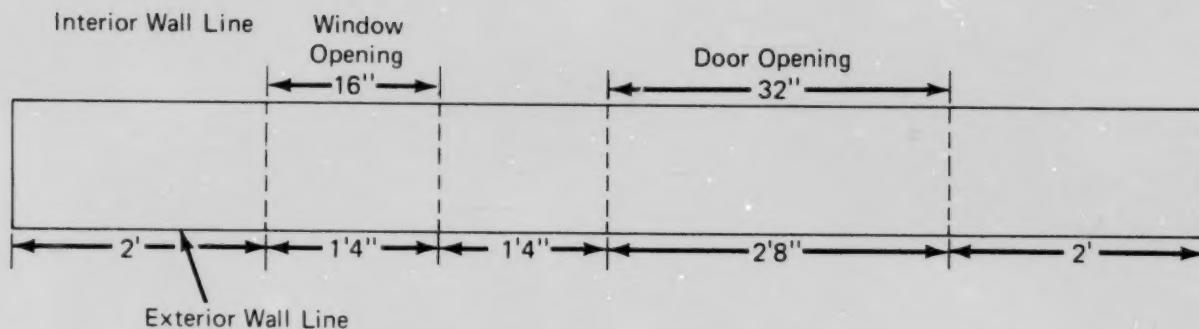
JOB SHEET #2

B. Lay out block bond

1. Measure with steel tape and mark door openings as shown on plan (Figure 3)

(NOTE: When marking door opening, use a piece of keel or marking crayon.)

FIGURE 3

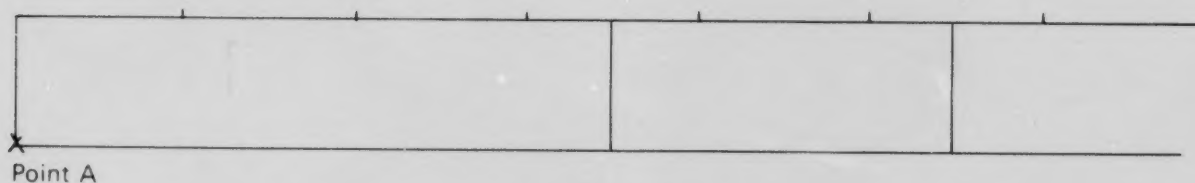


2. Square door opening from the exterior to interior wall lines

(NOTE: Mark door jamb with marking crayon.)

3. Measure with steel tape and mark block bond every 16" (Figure 4)

FIGURE 4



(NOTE: Mark block bond through door opening to end of wall. This will assure a good bond when blocks are laid across top of door opening.)

C. Lay first course of blocks

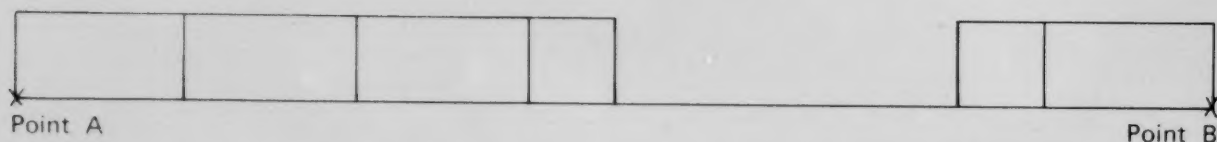
(NOTE: Check each course height with story pole.)

JOB SHEET #2

- D. Check door opening for accurate dimensions (Figure 5)

(NOTE: Instructors may have student build a rough door frame to keep door opening accurate.)

FIGURE 5

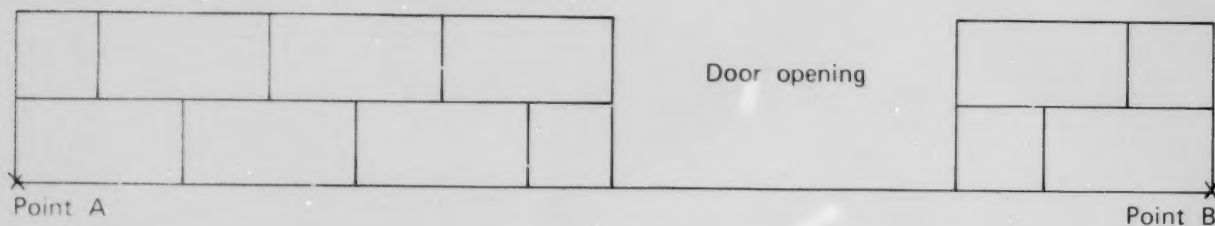


- E. Remove mason's line

(NOTE: This is the first course of the wall. It is very critical that the blocks be in proper alignment with wall lines and are plumb and square.)

- F. Lay second course of blocks (Figure 6)

FIGURE 6



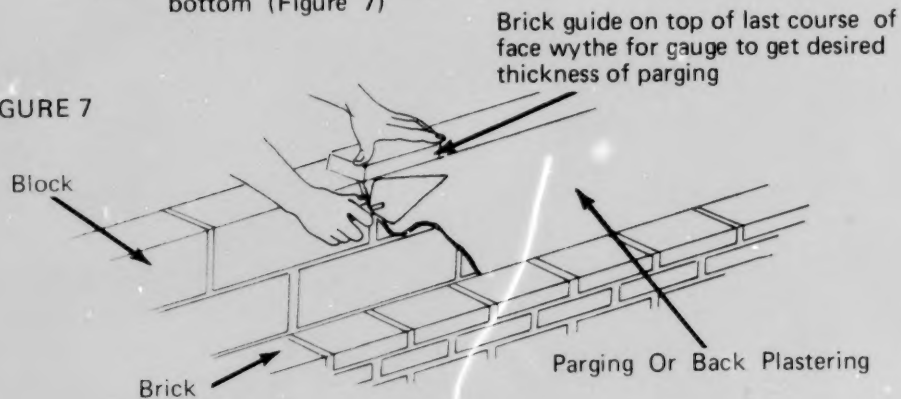
- G. Parge the exterior face of the concrete blocks

1. Pick up mortar with back of trowel

JOB SHEET #2

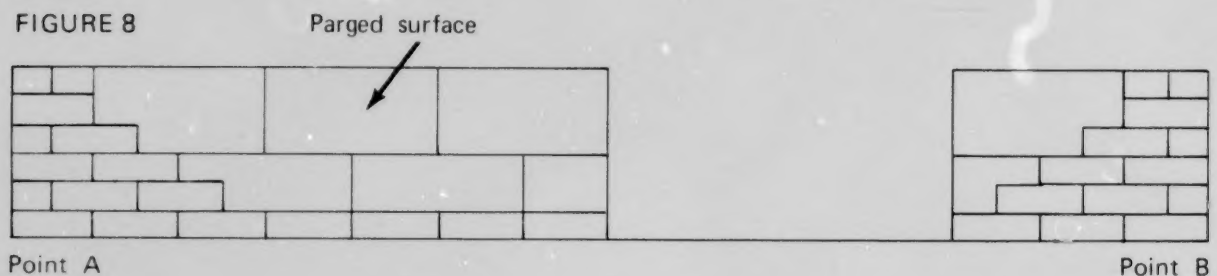
2. Apply a coat of mortar to the face of the block starting at the bottom (Figure 7)

FIGURE 7



- H. Remove any mortar dropped on the floor during parging
- I. Lay out dry bond for first course of brick
- J. Mark ends of each brick
- K. Remove dry bond
- L. Lay first course of brick
- M. Check door opening for accurate dimensions
- N. Build a five course lead at both point A and point B (Figure 8)

FIGURE 8



- O. Lay five courses of brick to line

(NOTE: A constant check should be made on door opening height. Also check to see if sixth course of brick is same as second course height of block.)

- P. Joint vertical and horizontal joints if necessary

JOB SHEET #2

Q. Use joint reinforcement for a 12" wall with brick facing and 8" block on interior

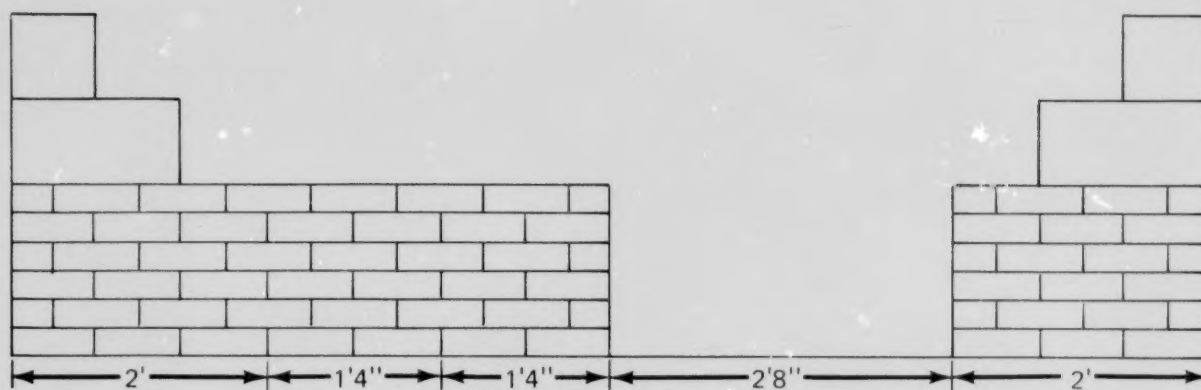
1. Use bolt cutters to cut reinforcement 1" shorter for wall starting at point A to door jamb
2. Cut reinforcement for wall starting at point B to door jamb

(NOTE: Keep joint reinforcement centered on wall.)

R. Lay two course block lead at both point A and B

1. Mark out window opening shown on shop plan, using steel tape
2. Square window opening from marks that were taped to the interior wall line (Figure 9)

FIGURE 9



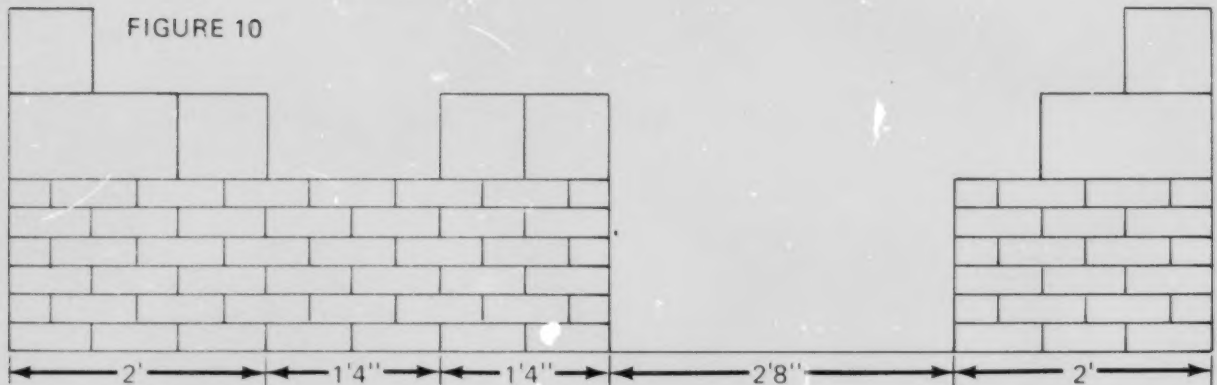
S. Lay two courses of block

T. Check window opening for accurate dimensions

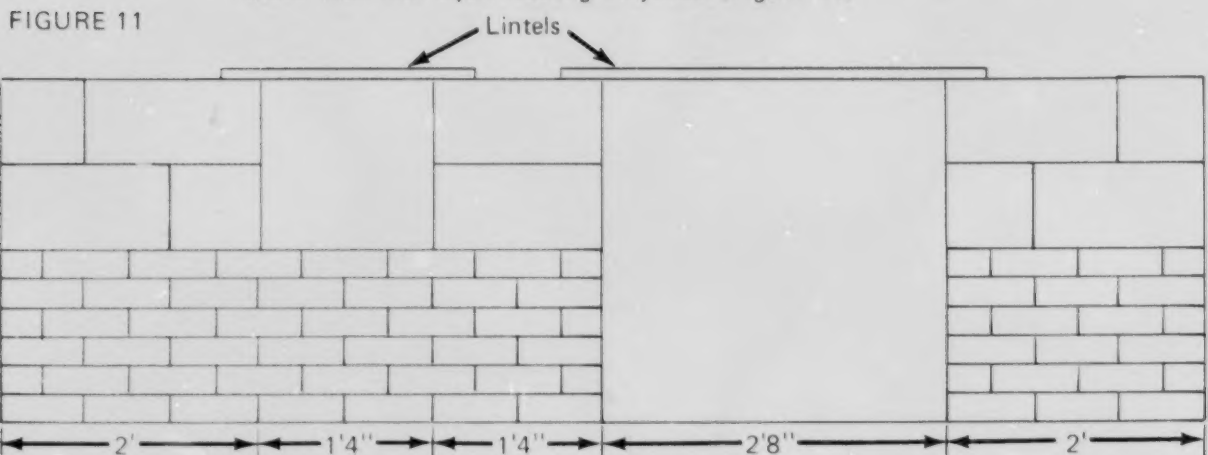
JOB SHEET #2

- U. Cut half block using the masonry saw so that it will measure $7 \frac{1}{4}"$ at its length (Figure 10)

(NOTE: This should be done before placing mortar for half blocks. The half block is cut because the full block on next course measures $15 \frac{5}{8}"$ at its length.)



- V. Plumb window and door opening making sure they are perfectly plumb and level at tops of openings
- W. Place lintels over block opening back to back and keep them centered on block wall and equal bearing at jambs (Figure 11)

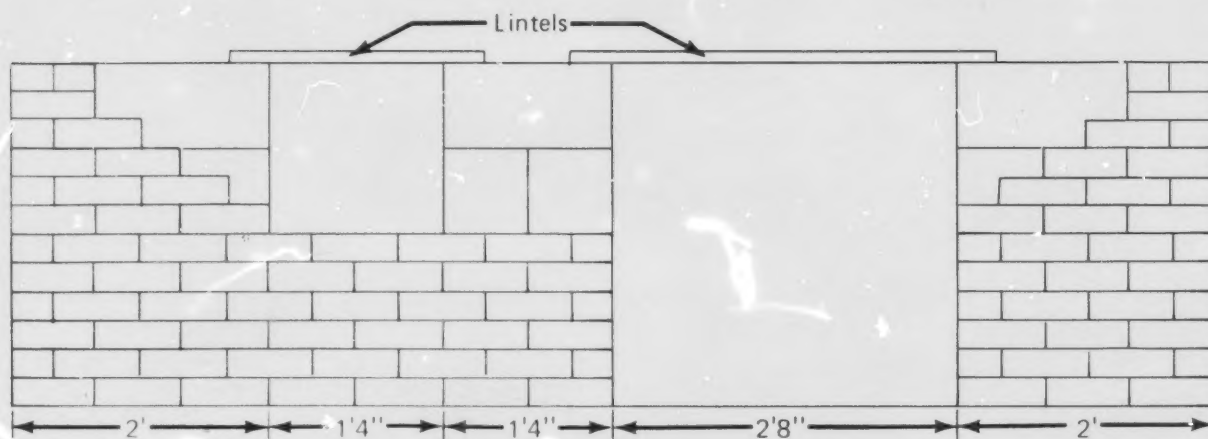


- X. Check stiffness of mortar joints and joint if necessary using round jointer

(NOTE: Pick up mortar on back of wall that may have dropped when laying block and return it to mortar board.)

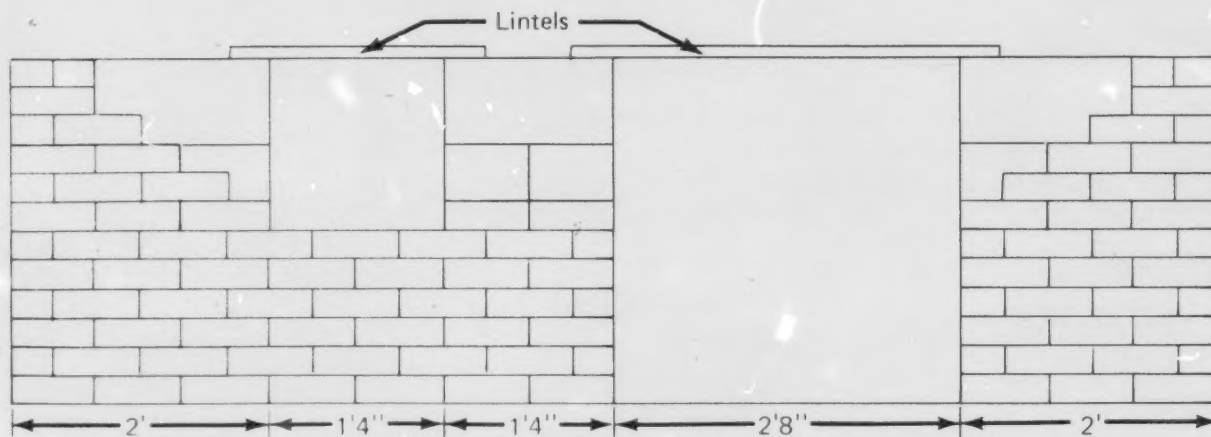
JOB SHEET #2

- Y. Temper mortar if necessary so that you will have a good workable mortar body
- Z. Parge the exterior face of the concrete block
- AA. Scrape off mortar on brick course that may have dropped during parging of the block wall
- BB. Lay six course brick lead at both point A and B (Figure 12)



Front View Showing Brick Bond With Door And Window Openings

- CC. Lay six courses of brick (Figure 13)



Front View Showing Brick Bond With Door And Window Openings

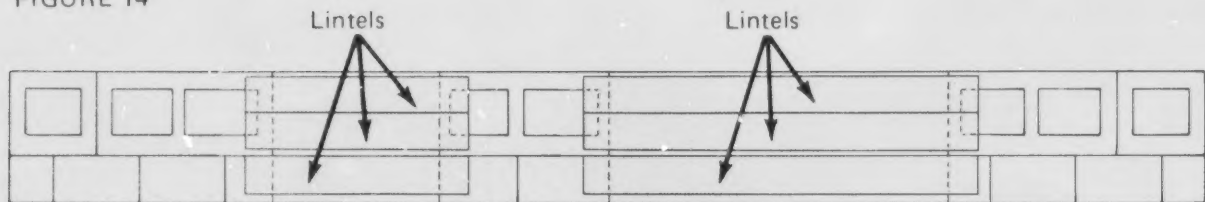
- DD. Check window and door jambs to see if plumb
- EE. Check mortar in joints; joint if necessary

JOB SHEET #2

FF. Place lintels over tops of openings, keeping back of lintel tight against parging so that you will have enough room to lay brick across angle without cutting backs of brick

(NOTE: Make sure that you have equal bearing on jambs. See Figure 14.)

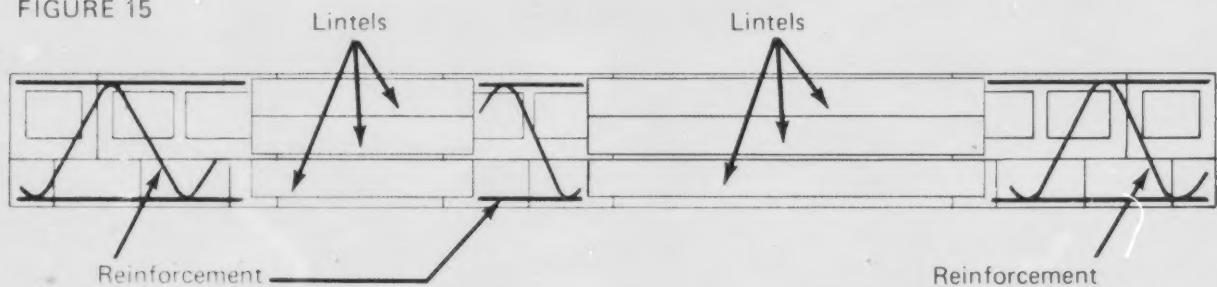
FIGURE 14



GG. Use bolt cutters to cut joint reinforcement to fit between lintels and from lintels to ends of wall, keeping reinforcement 1/2" from the end of wall (Figure 15)

(NOTE: Keep reinforcement centered on wall.)

FIGURE 15



JOB SHEET #2

HH. Cut five blocks that have to be laid on lintel

(NOTE: This should be done before you start laying the fifth course or the last course of block on the wall.)

II. Place top of block or thick side of block down on table of masonry saw, lining it up square with blade and 2" outside of blade

JJ. Cut webs of block to a depth of 4" for the full length of block

KK. Move block over and repeat the same procedure, keeping block on table and cutting webs the full length of the block

(NOTE: Make sure to hold block firmly with both hands and keep fingers away from blade. Wear goggles and dust respirators.)

LL. Tap cut webs gently with brick hammer so that you will not fracture block

(NOTE: Only one block has to be cut the full length of block.)

MM. Cut four more blocks using the same procedure but leaving the last web on block

NN. Lay fifth course of block

OO. Parge exterior face of blocks and clean brick course of any mortar that may have dropped during parging

PP. Build three course lead of brick at points A and B

QQ. Lay three courses of brick to line

(NOTE: When laying the first course of brick on lintel or top of opening, do not place mortar on lintel. If wall is to be continued, joint reinforcement should be placed on first course of block above opening. Place reinforcement every two courses of blocks for the remainder of the height of the wall.)

RR. Have instructor to evaluate

WALL LAYOUT AND CONSTRUCTION UNIT II

TEST

1. Match the terms on the right to the correct definitions. (Definitions are continued on the next page.)

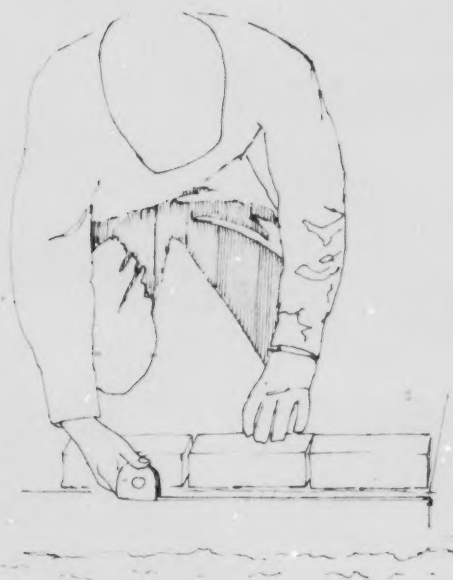
- | | |
|--|-------------------------|
| _____ a. Process designed to weatherproof and beautify the mortar joint | 1. Layout |
| _____ b. Section of wall built in advance of the rest of the wall to determine wall lines and elevations | 2. Brick bond |
| _____ c. Sheet metal of special shapes and designs to be used at various sections of the wall for waterproofing | 3. Dry bonding |
| _____ d. Masonry wall built with a particular type designed pattern of steel reinforcement | 4. Load-bearing wall |
| _____ e. Procedure to establish wall lines, bonds, openings, elevations, and type of wall to be constructed | 5. Nonload-bearing wall |
| _____ f. Method of determining brick bond by laying brick without mortar | 6. Through-wall bonding |
| _____ g. Method of bonding or tying together the outer and inner walls | 7. Flashing |
| _____ h. Wall that supports the floors and roof of the building | 8. Lead |
| _____ i. Specifies that the wall is built high enough and is ready for scaffold to be built so the wall can continue to be constructed | 9. Tooling |
| _____ j. Length of 1" x 2" piece of wood at least 8' in length with brick coursing marked out on it along with elevation of all things occurring in a certain wall section | 10. Wall protection |
| _____ k. Method used to protect walls from damage during construction | 11. Reinforced masonry |
| | 12. Scaffold high |
| | 13. Story pole |
| | 14. Scaffold |
| | 15. Lintel |
| | 16. Keel |
| | 17. Parging |
| | 18. Wythe |
| | 19. Grout |
| | 20. Grouted masonry |

- _____ l. Wall that has no structural tie to the building by allowing floors or roofs to bear their weight on it
 - _____ m. Process of applying a layer of mortar to vertical face of masonry units
 - _____ n. Temporary structure or platform to support workmen and material during construction
 - _____ o. Engineer's crayon
 - _____ p. Pattern to which bricks are laid
 - _____ q. Piece of steel used to receive masonry units over tops of doors and windows
 - _____ r. Masonry in which the interior joints are filled in with grout as the work progresses
 - _____ s. Continuous section of masonry, one unit in thickness
 - _____ t. Thin mortar which will pour without separation of the ingredients
2. Discuss in a short paragraph the purposes of laying out brick bonds.

3. Identify the following two methods of layout in the illustrations below.



a. _____



b. _____

4. Discuss in a short paragraph the purposes of bonds.

5. Identify the types of bonds in the diagrams below by writing the correct names in the blanks provided.

Herringbone flat

Stack

Common or Flemish header

English cross or Dutch

Basket weave on edge

Basket weave flat

Running

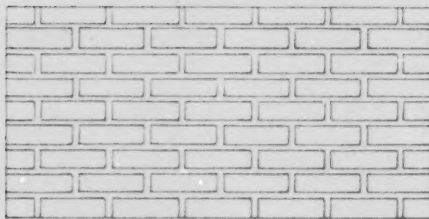
Herringbone regular

Flemish

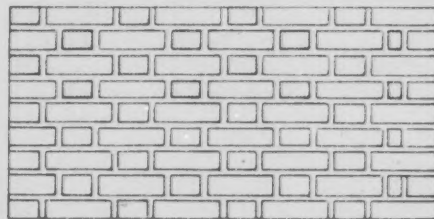
English

Common or full header

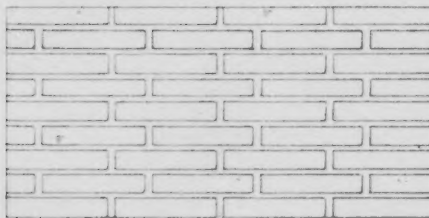
1/3 running



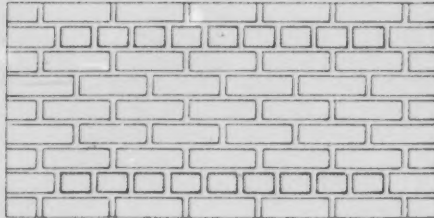
a. _____



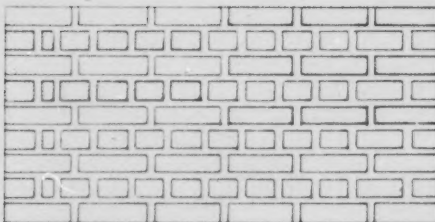
b. _____



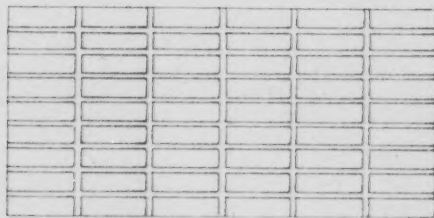
c. _____



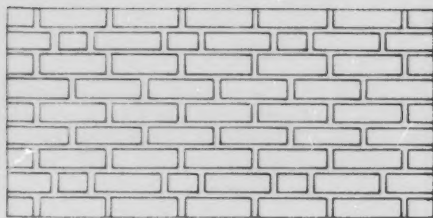
d. _____



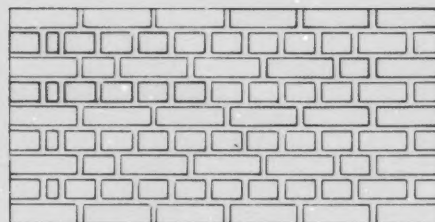
e. _____



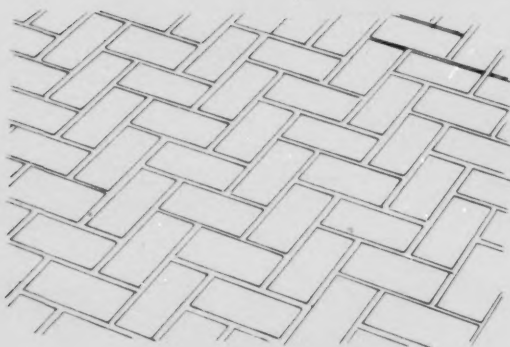
f. _____



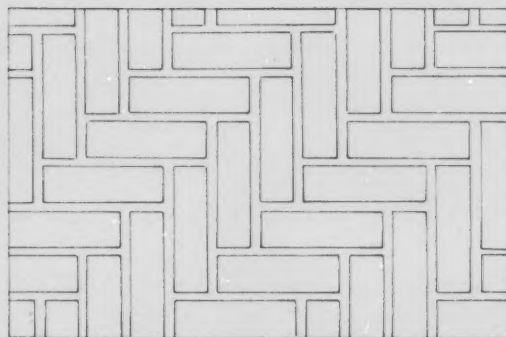
g. _____



h. _____



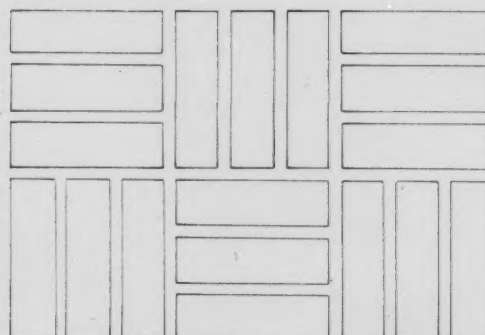
i. _____



j. _____

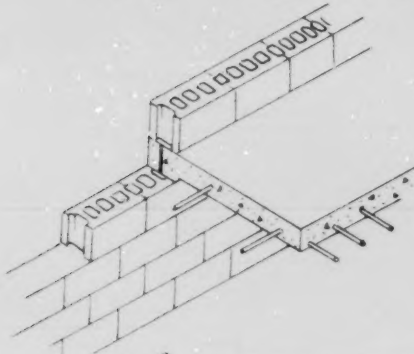


k. _____

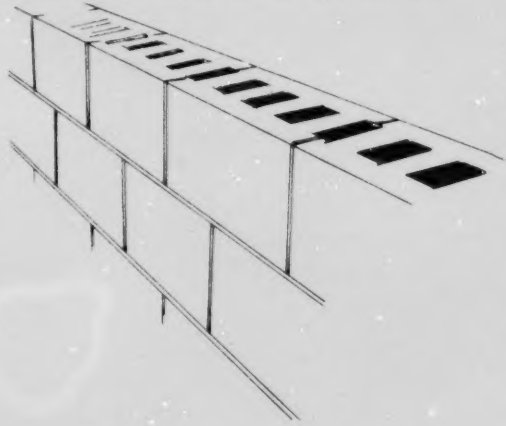


l. _____

6. Distinguish between load-bearing and nonload-bearing walls by writing the correct names in the blanks provided.



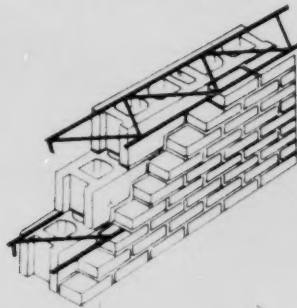
a. _____



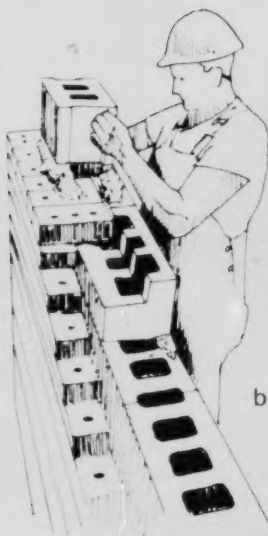
b. _____

7. State the purpose of through-wall bonding.

8. Identify the types of through-wall bonding in the diagrams below by writing the correct names in the blanks provided.



a. _____



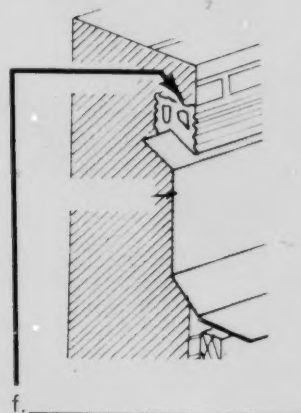
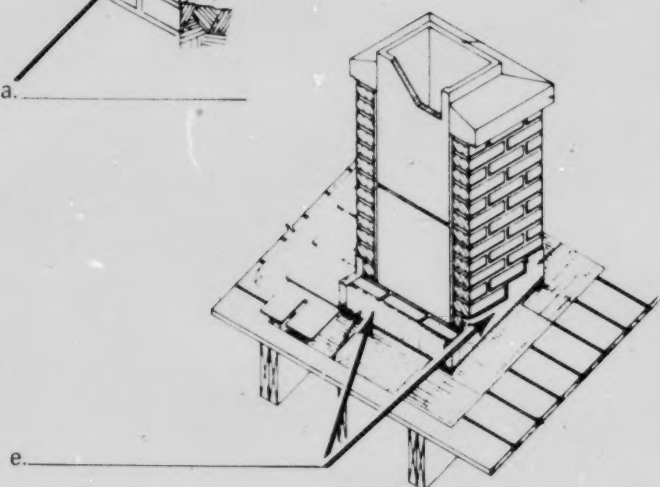
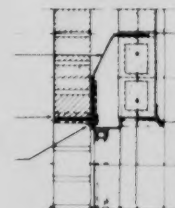
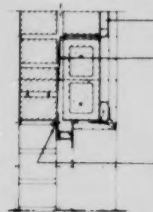
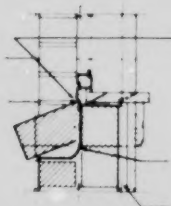
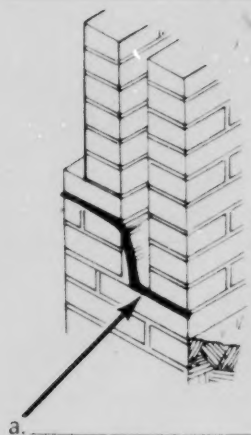
b. _____



c. _____

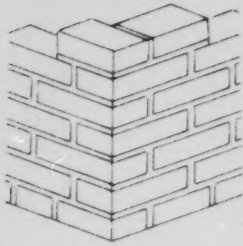
9. State the purposes of grouting.
 - a.
 - b.
10. List two types of reinforcement.
 - a.
 - b.
11. Discuss in a short paragraph the purposes of flashing.

12. Identify the types of flashing in the diagrams below by writing the correct names in the blanks provided.

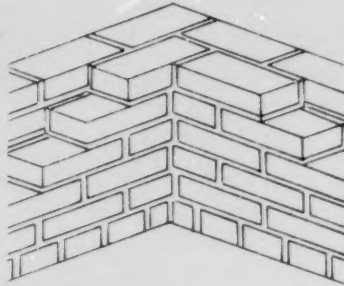


13. Discuss in a short paragraph the purposes of leads.

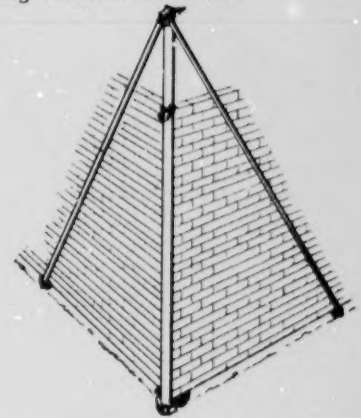
14. Identify the types of leads in the diagrams below by writing the correct names in the blanks provided.



a. _____



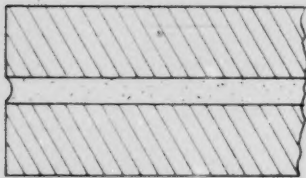
b. _____



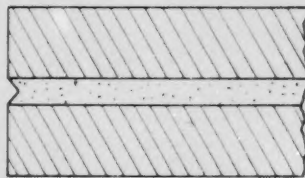
c. _____

15. Discuss in a short paragraph the purposes of tooling.

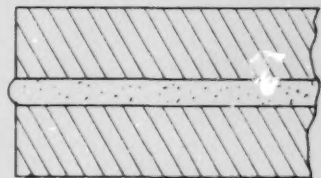
16. Identify the types of tooling in the diagrams below by writing the correct names in the blanks provided.



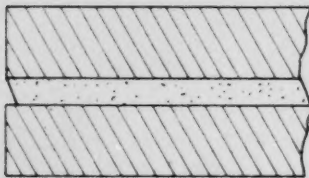
a. _____



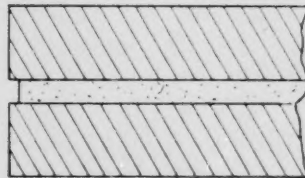
b. _____



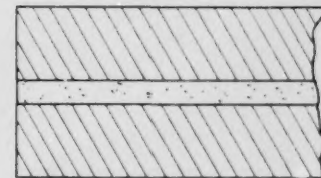
c. _____



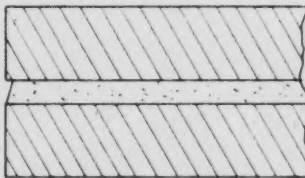
d. _____



e. _____



f. _____



g. _____

17. Discuss in a short paragraph the purposes of wall protection.
18. Name two methods used in wall protection.
 - a.
 - b.
19. Discuss in a short paragraph the purposes of reinforced masonry.
20. Name six types of reinforced masonry.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
21. Demonstrate the ability to:
 - a. Lay out and construct a section of wall with a joint reinforcement.
 - b. Lay out and construct a section of wall with openings and joint reinforcement.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

WALL LAYOUT AND CONSTRUCTION
UNIT II

ANSWERS TO TEST

- | | | | | |
|----|-------|-------|-------|-------|
| 1. | a. 9 | g. 6 | m. 17 | s. 18 |
| | b. 8 | h. 4 | n. 14 | t. 19 |
| | c. 7 | i. 12 | o. 16 | |
| | d. 11 | j. 13 | p. 2 | |
| | e. 1 | k. 10 | q. 15 | |
| | f. 3 | l. 5 | r. 20 | |
2. Discussion should include:
- a. Establish in place and mark the position of each brick of the first course to ensure a true bond
 - b. Locate doors, windows, and other openings so that the bond can be regulated or fitted to dimensions called for on the blueprint
- 3.
- a. Dry bonding
 - b. Steel tape bonding
4. Discussion should include:
- a. Add strength and rigidity to the wall
 - b. Beautify through design and economy of design
- 5.
- a. Running
 - b. Flemish
 - c. 1/3 running
 - d. Common or full header
 - e. English
 - f. Stack
 - g. Common or Flemish header

- h. English cross or Dutch
- i. Herringbone flat
- j. Herringbone regular
- k. Basket weave flat
- l. Basket weave on edge
- 6. a. Load-bearing wall
b. Nonload-bearing wall
- 7. Tie together outer and inner wythes
- 8. a. Joint reinforcement
b. Header construction
c. Grouting and reinforcement
- 9. a. Provide greater strength in walls
b. Form a single unit of construction to resist forces
- 10. Any two of the following:
 - a. Low-lift grout
 - b. High-lift grout
 - c. Reinforcing steel
 - 1) Rods or bars
 - 2) Wire
 - 3) Wire screen
 - 4) Metal lathe
- 11. Discussion should include:
 - a. Divert water
 - b. Act as a sealant
- 12. a. Through-wall
b. Sill
c. Window

- d. Door
 - e. Counter
 - f. Raggle
13. Discussion should include:
- a. Establish wall elevation
 - b. Establish wall pattern
 - c. Act as guide for wall construction
- 14.
- a. Outside corner
 - b. Angle or inside corner
 - c. Corner pole
15. Discussion should include:
- a. Seal and weatherproof mortar joints
 - b. Add design or ornamental value
- 16.
- a. Round or concave joint
 - b. V-joint
 - c. Beaded or convex joint
 - d. Struck joint
 - e. Raked joint
 - f. Flush joint
 - g. Weather joint
17. Discussion should include:
- a. Protect from water induction during construction
 - b. Protect from blowing down
 - c. Protect from freezing
 - d. Protect from staining

18.
 - a. Cover wall
 - b. Brace wall
19. Discussion should include:
 - a. Develop greater wall strength
 - b. Create resistance to tensile, shearing, and compression stresses
20.
 - a. Reinforced brick masonry (RBM method)
 - b. High lift grouted reinforced brick masonry
 - c. Reinforced masonry retaining walls
 - d. Reinforced brick and tile lintels
 - e. Reinforced brick masonry columns and pilasters
 - f. Reinforced brick masonry swimming pools
21. Performance skills evaluated to the satisfaction of the instructor

CHIMNEYS AND FIREPLACES UNIT III

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to identify types and parts of fireplaces. The student should be able to discuss the procedure for buttering firebrick and name characteristics of firebrick. The student should be able to construct a firebox and a fireplace. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with chimneys and fireplaces to the correct definitions.
2. Identify types of fireplaces.
3. Identify parts of a fireplace.
4. Select from a list the proper factors to consider in constructing fireplaces and chimneys.
5. Discuss in a short paragraph the procedure for buttering a firebrick.
6. Distinguish between firebrick mortar and brick mortar.
7. Name the characteristics of firebrick.
8. Select from a list proper characteristics of a firebox.
9. Demonstrate the ability to:
 - a. Construct a firebox.
 - b. Construct a fireplace.

CHIMNEYS AND FIREPLACES UNIT III

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate the procedures outlined on the job sheets.

(NOTE: Student should have the opportunity either in the lab or on the job to complete both job sheets.)

- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Types of Fireplaces
 - 2. TM 2--Parts of a Fireplace

D. Job sheets

1. Job Sheet #1--Construct a Firebox
2. Job Sheet #2--Construct a Fireplace

E. Test

F. Answers to test

II. References:

- A. Ray, J. Edgar. *The Art of Bricklaying*. 3rd ed. Revised by Harold V. Johnson. Peoria, Illinois: Chas. A. Bennett Co., 1971.
- B. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.
- C. Graham, Frank D. *Audels Masons and Builders Guide*. Vol. 1. Indianapolis, Indiana: Theodore Audel and Co./Howard W. Sams and Co., Inc., 1967.

CHIMNEYS AND FIREPLACES UNIT III

INFORMATION SHEET

I. Terms and definitions

- A. Flashing--Thin material placed in mortar joints and through air spaces in masonry to prevent water penetration and/or provide water drainage
- B. Corbel--Shelf or ledge formed by projecting successive courses of masonry out from the face of the wall
- C. Refractory--Any brick which is especially made to withstand the effects of high heat without fusion
- D. Firebrick--Brick made of refractory ceramic material which will resist high temperatures
- E. Flue lining--Passage in a chimney especially for the exit of smoke and gases, one or more of which may be enclosed in the same chimney
- F. Mantle--Shelf projecting beyond the face of the fireplace
- G. Damper--Metal frame with adjustable door that sits on top of firebrick of the combustion chamber
- H. Ash dump--Metal door set in brick on the floor of the firebox or combustion chamber for dumping ashes into ash pit
- I. Throat--Opening at the top of a fireplace through which the smoke passes to the smoke chamber and chimney
- J. Smoke chamber--Space in a fireplace immediately above the throat where the smoke gathers before passing into the flue; narrowed by cutting brick and parging to the size of the flue lining above
- K. Firestop--Projection of brickwork on the walls between the joist to prevent the spread of fire
- L. Cap--Reinforced piece of concrete at top of chimney
- M. Smoke shelf--Shelf directly in back of throat of damper; prevents downdraft
- N. Cleanout door--Metal-framed door used to clean out ashes
- O. Brick outer hearth--Brick or tile floor that extends out from the face of the fireplace and the full length of the fireplace

INFORMATION SHEET

P. Reinforced brick slab--Brick slab that covers the entire top of the ash pit and extends out to receive outer hearth

Q. Breast--That part of the fireplace above the jambs and opening

II. Types of fireplaces (Transparency 1)

A. Single face

B. Two face (adjacent)

C. Two face (opposite)

D. Three face (2 long, 1 short)

III. Parts of a fireplace (Transparency 2)

A. Cap

B. Flashing

C. Firestop

D. Flue lining

E. Smoke chamber

F. Mantle

G. Smoke shelf

H. Damper

I. Firebrick

J. Ash dump

K. Brick outer hearth

L. Reinforced brick slab

M. Cleanout door

N. Ash pit

O. Throat

P. Breast

INFORMATION SHEET

IV. Factors to consider in constructing fireplaces and chimneys

- A. Fireplace should be laid out on first floor
- B. Brickwork below the fireplace is the same perimeter as the fireplace
- C. The size of damper specified is the finished fireplace opening
- D. Finished opening height should be less than the width of finished opening of fireplace
- E. Bottom of damper should be six to eight inches above the top of finished opening
- F. Smoke shelf should be kept level with bottom of damper
- G. Damper should be measured at bottom of inside for fireplace opening and sides of firebox
- H. Chimney should be three feet above the highest point where it passes through the roof of a building and at least two feet higher than any portion of the building within ten feet

(NOTE: Distance and dimension will vary according to building code.)

V. Procedure for buttering firebrick

- A. Do not wet firebrick
 - B. Mix fireclay so that it will have a consistency of heavy whipped cream
- (NOTE: Some areas permit laying firebrick with regular brick mortar.)

- C. Butter firebrick with trowel

(NOTE: Fireclay joints should be kept very tight.)

VI. Firebrick mortar vs brick mortar

- A. Firebrick mortar
 - 1. Withstands intensive heat
 - 2. Cannot be used on exterior

INFORMATION SHEET

3. Is very plastic
4. Does not require sand
5. Requires water

B. Brick mortar

1. Contains cement, lime, sand, and water
2. Is used for bonding brick and block
3. Can be used on interior or exterior
4. Will resist rain after hardening

VII. Characteristics of firebrick

- A. Larger in size than regular brick
- B. Resistant to high temperatures

(NOTE: Firebrick is used in high temperature furnaces.)

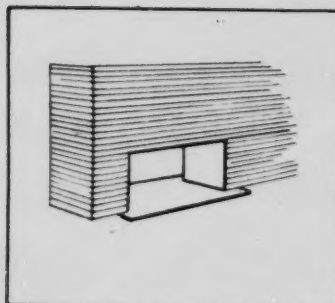
- C. Sensitive to moisture and cold

VIII. Characteristics of a firebox

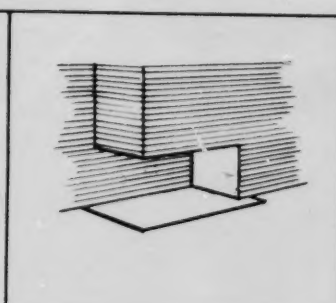
- A. The slope of the back throws the flame forward and leads the gases through the throat with increasing velocity
- B. The angle of the sides gives maximum radiation of heat into the room

Types of Fireplaces

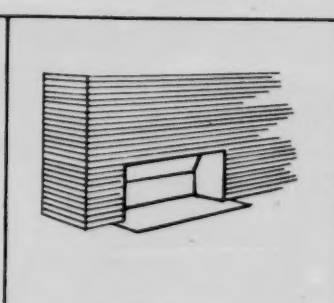
TWO FACE
(Opposite)



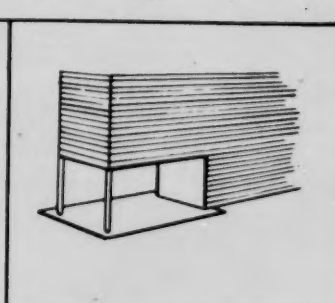
TWO FACE
(Adjacent)



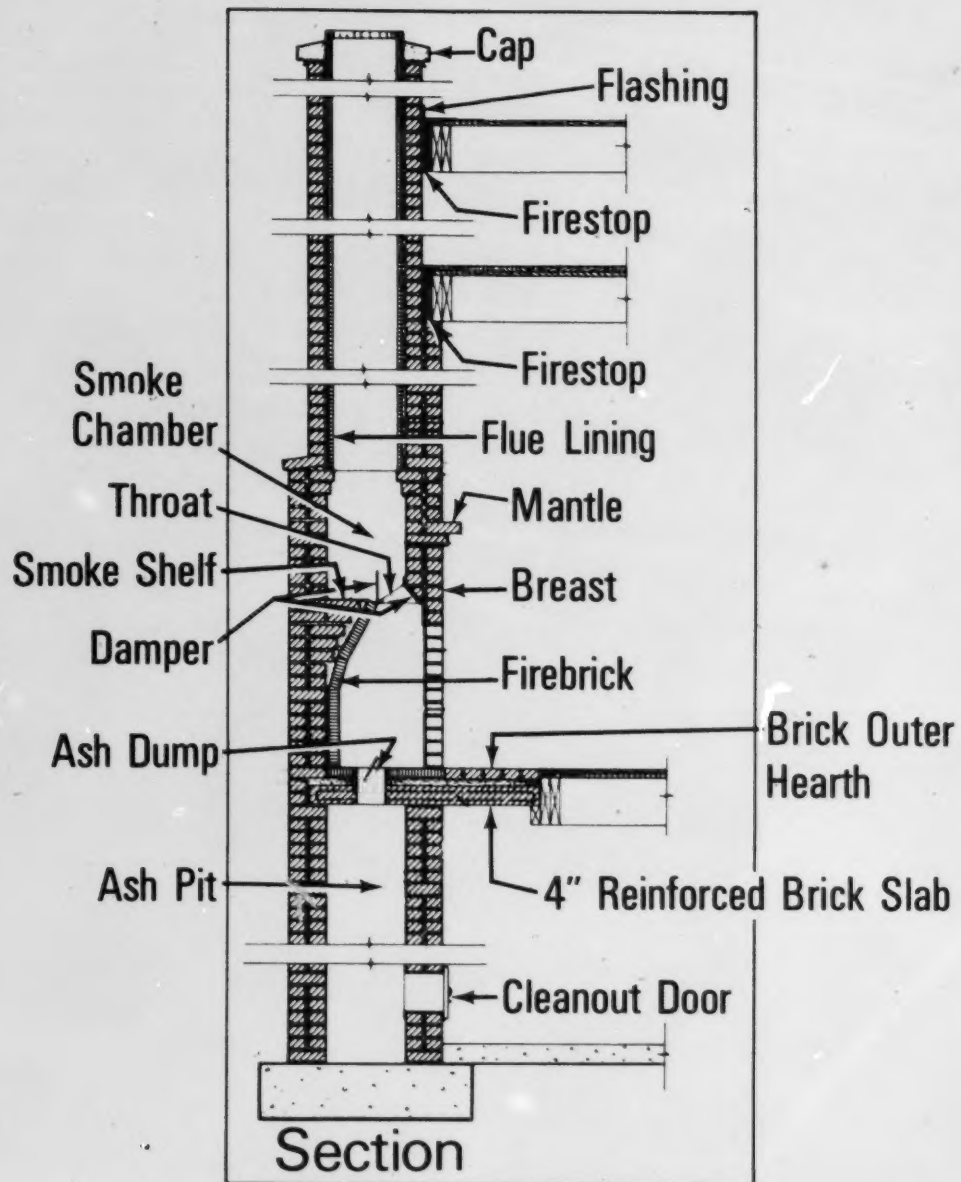
SINGLE FACE



THREE FACE
(2 Long, 1 Short)



Parts of a Fireplace



BL 169-G

CHIMNEYS AND FIREPLACES
UNIT III

JOB SHEET #1--CONSTRUCT A FIREBOX

I. Tools and materials

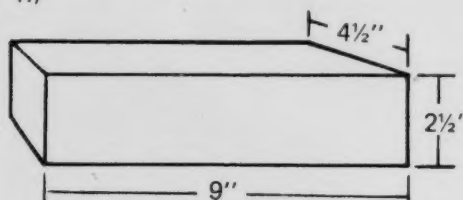
- A. Ash dump
- B. Damper, 3'
- C. Firebrick, 90
- D. Laboratory mortar
- E. Rule, 6'
- F. Trowel
- G. Brick hammer
- H. Brick set
- I. Level, 4'
- J. Framing square
- K. Bevel square
- L. Soft hand brush
- M. Mortar board
- N. Square shovel, #2
- O. Pail, 5 gallon
- P. Flat wooden wheelbarrow
- Q. Bag of sand

II. Procedure

- A. Lay firebrick flat with the wide side down for the floor of firebox

(NOTE: The firebrick should be 9" long, 4 1/2" wide, and 2 1/2" high. See Figure 1.)

FIGURE 1

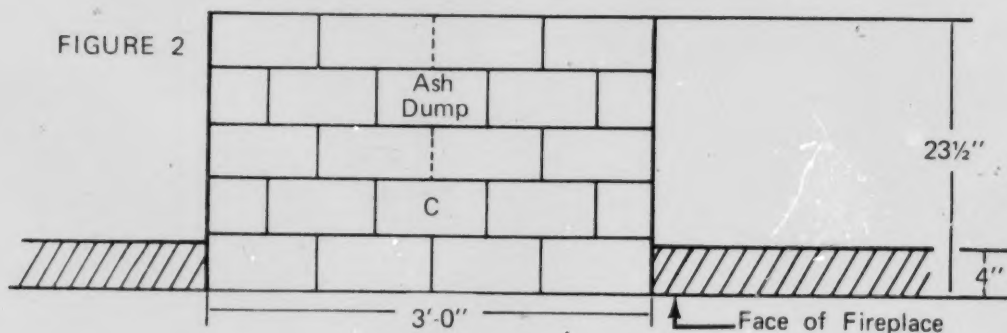


JOB SHEET #1

- B. Lay firebrick, using brick mortar for bed joint and buttering the sides and end joints with brick mortar

(NOTE: Keep about 1/4" to 3/8" joint for horizontal and end joints.)

- C. Start first course at face of fireplace to a depth of about 23 1/2" or 5 courses laid flat (Figure 2)



- D. Keep bond centered with fireplace opening

(NOTE: Keep firebox floor perfectly level. Set ash dump on center of firebox in the fourth course.)

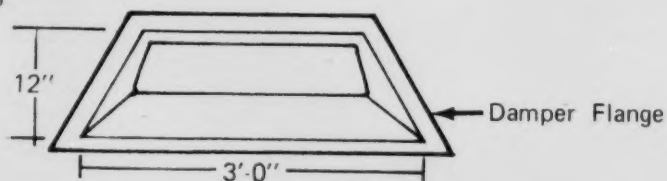
- E. Joint end and horizontal joints with flat jointer

(NOTE: When all joints have been jointed, brush off floor of firebox and rejoin with flat jointer.)

- F. Place cast-iron damper flat on floor of firebox with its longest length facing fireplace opening after floor of firebox has been completed (Figure 3)

(NOTE: Handle damper with care; if dropped, it could be fractured.)

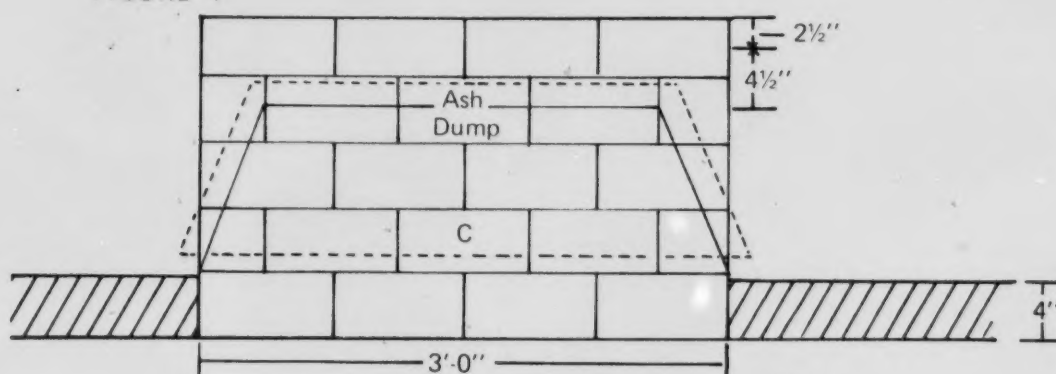
FIGURE 3



JOB SHEET #1

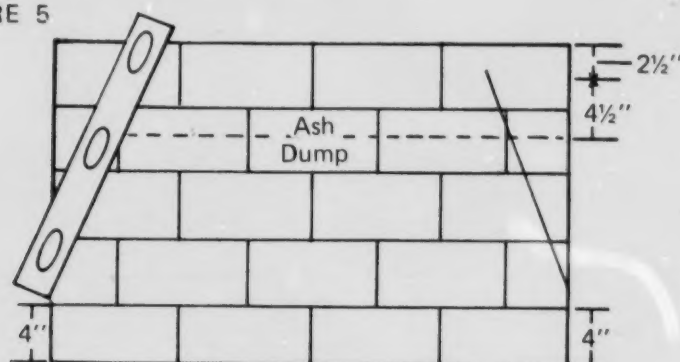
- G. Keep outside of flange of damper 4" back from face of fireplace opening; keep it centered with fireplace opening (Figure 4)

FIGURE 4



- H. Mark the inside of the damper on the two sides and back with a heavy duty pencil
- I. Remove damper
- J. Place edge of level on marks that were marked for the sides or the splay of the firebox and continue the lines to the back of the firebox on both sides (Figure 5)

FIGURE 5

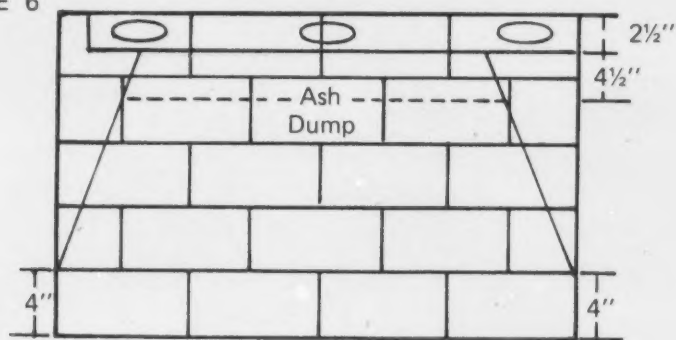


- K. Measure 2 1/2" from the back of the floor of the firebox where both ends of the splay are marked

JOB SHEET #1

- L. Place edge of level on the 2 1/2" marks and draw line with pencil (Figure 6)

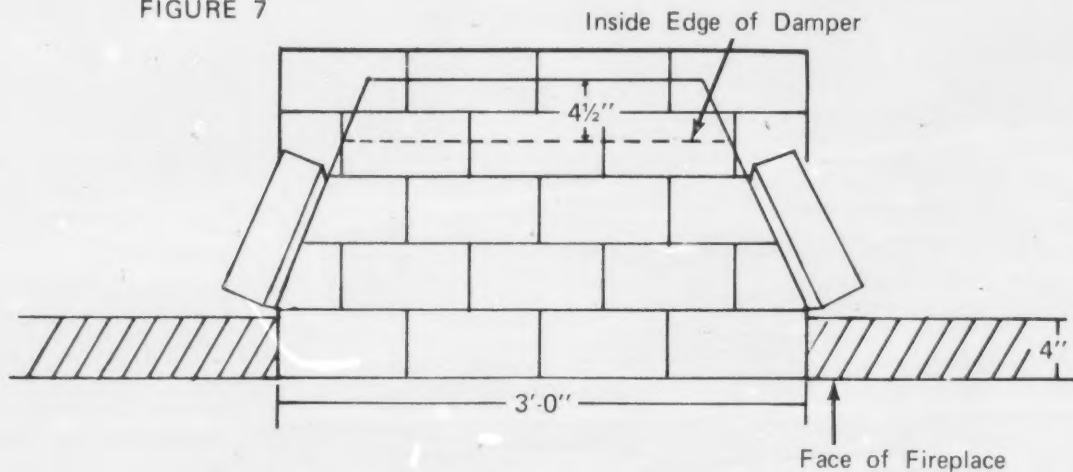
FIGURE 6



- M. Lay out the dry bond for the first course of firebrick with firebrick on edge for the firebox, starting bond 4" back from the face of the fireplace opening on both sides and keeping 1/4" to 3/8" end joints

(NOTE: Make sure to stay with lines outlining the firebox. See Figure 7.)

FIGURE 7

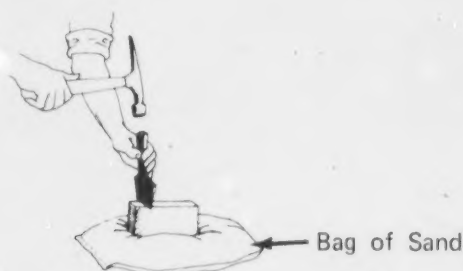


JOB SHEET #1

- N. Make firebrick cuts, marking brick so that you will have about $\frac{1}{4}$ " to $\frac{3}{8}$ " end joints

(NOTE: Before cutting firebrick with a brick set, fill a burlap bag with sand and place brick on top of filled bag. See Figure 8. This reduces the shock on the brick and makes for an easier and better cut with less breakage. Make cuts with masonry table saw if available.)

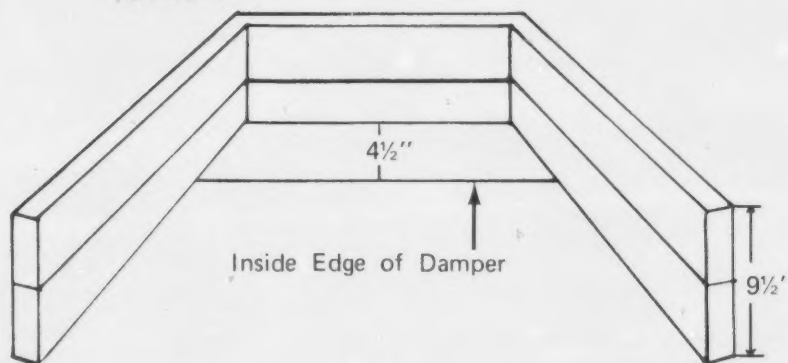
FIGURE 8



- O. Lay two courses of brick on edge at a height of $4\frac{3}{4}$ " for each course, buttering end of brick so that you will have solid end joints and bed joints

(NOTE: Make sure to keep walls level and plumb. The height for the two courses laid should measure $9\frac{1}{2}$ " from floor of firebox to top of second course. See Figure 9. The measurement from the inside of the damper to the back wall is $4\frac{1}{2}$ ". This is how much the back wall will slope forward. Before you lay any more brick you have to know the angle or the slope of the back wall.)

FIGURE 9



JOB SHEET #1

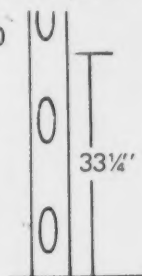
- P. Joint the two courses laid with round jointer

(NOTE: The side walls when completed will be at a height of $33 \frac{1}{4}$ " from floor of firebox to top of side walls or bottom of damper.)

- Q. Lay five more courses at $4 \frac{3}{4}$ " per course for a total measurement of $23 \frac{3}{4}$ " from the top of the second course
- R. Place 4' level on wood or concrete floor and draw a line the full length of the level measuring from the bottom of the line and marking it at $33 \frac{1}{4}$ " (Figure 10)

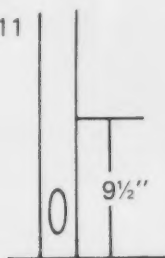
(NOTE: This determines the slope of the back wall.)

FIGURE 10



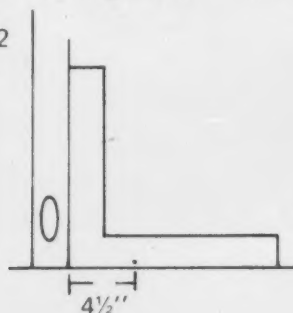
- S. Measure up $9 \frac{1}{2}$ " from the bottom of the mark made with the level (Figure 11)

FIGURE 11



- T. Square the $9 \frac{1}{2}$ " mark with framing square by placing square with line drawn with level and drawing a line $4 \frac{1}{2}$ " long (Figure 12)

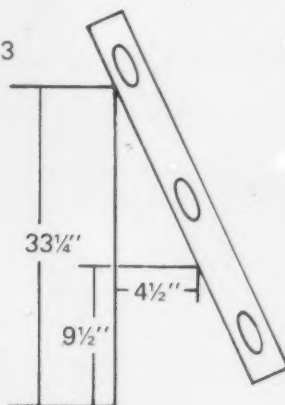
FIGURE 12



JOB SHEET #1

- U. Place edge of level on end of $4\frac{1}{2}$ " line and on mark at $33\frac{1}{4}$ "; draw line (Figure 13)

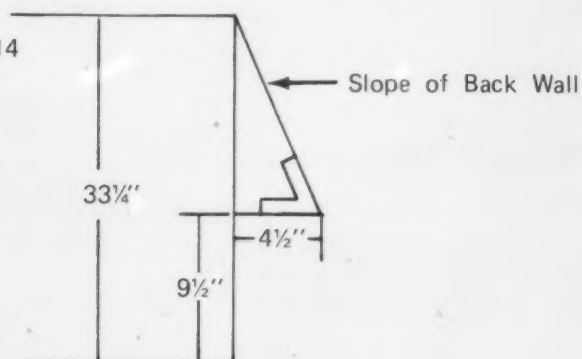
FIGURE 13



- V. Set bevel square on $4\frac{1}{2}$ " mark and adjust it to angle that was drawn from the $4\frac{1}{2}$ " mark to the $33\frac{1}{4}$ " mark (Figure 14)

(NOTE: This will insure that the slant of the back wall will meet the inside of the damper at the top of the firebox.)

FIGURE 14



- W. Start laying firebricks from the fireplace opening until you reach the first firebrick that has to be cut for the slope of the back wall
- X. Place dry firebrick, keeping about $\frac{1}{2}$ " end joint away from the last brick laid
- Y. Mark brick at bottom with pencil in line with inside of back wall
- Z. Remove brick

JOB SHEET #1

AA. Draw line on brick using bevel square (Figure 15)

FIGURE 15

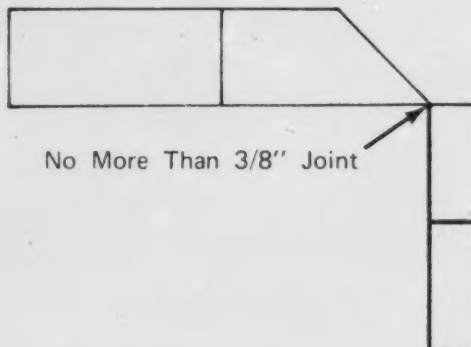


BB. Place brick on bag filled with sand and cut with brick set

(NOTE: Make cuts with masonry saw if available.)

CC. Lay brick, making sure end of brick at bottom is back $\frac{1}{4}$ " and no more than $\frac{3}{8}$ " away from back wall (Figure 16)

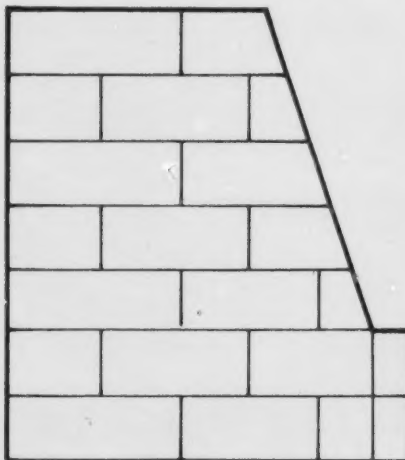
FIGURE 16



DD. Lay the four remaining courses to a height of $33 \frac{1}{4}$ " using the same procedures for laying course three (Figure 17)

(NOTE: Joint with round jointer if needed.)

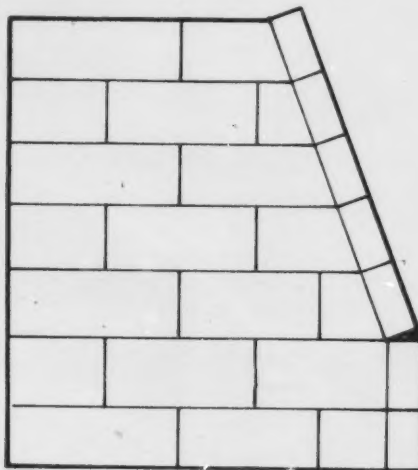
FIGURE 17



JOB SHEET #1

- EE. Lay brick on the other side wall of the firebox using the same procedures that were used for the completed side wall
- FF. Lay up the back wall keeping the bed joints and end joints filled solid to the top of the side walls (Figure 18)

FIGURE 18



- GG. Place mortar on the top course of the three sides and set damper, keeping front edge of flange with ends of side walls

(NOTE: Tap it gently into position with brick hammer handle so that you have a tight bed joint.)

(CAUTION: Tap damper very gently because it is made of cast iron and can be easily cracked or broken.)

- HH. Cut mortar off the face of the bed joint on the inside or the bottom of damper with trowel
- II. Joint bed joint with flat jointer to assure a good tight bed joint under damper

CHIMNEYS AND FIREPLACES
UNIT III

JOB SHEET #2-CONSTRUCT A FIREPLACE

I. Tools and materials

- A. Damper, 3'
 - B. Ash dump
 - C. Cleanout door
 - D. Angle iron (1" x 1" x 1/8" x 3' 8"), 22
 - E. Angle iron, 3" x 3" x 1/4" x 3' 8"
 - F. Angle iron, 3 1/2" x 3 1/2" x 1/4" x 4'
 - G. Flue linings (12" x 12"), 6
 - H. Firebrick, 180
 - I. Common brick, 2500
 - J. Face brick for fireplace and chimney on roof, 300
 - K. Portland cement, 14 bags
 - L. Hydrated lime or laboratory mortar, 13 bags
 - M. Brick sand or laboratory mortar, 2 cubic yards
 - N. Fireclay, 1 bag
- (NOTE: In laboratory use pure lime.)
- O. Fireproof insulation to cover outside of damper
 - P. Quarry tile (6" x 6"), 42
 - Q. Common nails, assortment of 6", 8", and 10"
 - R. Light gauge metal ties, 24
 - S. Mortar mixer
 - T. Mortar bed
 - U. Metal wheelbarrow
 - V. Pails (5 gallon), 2

JOB SHEET #2

- W. Round-pointed shovel
- X. Square-pointed shovel
- Y. Wooden horses (2 foot), 6
- Z. Scaffold planks (14 foot), 10
- AA. Scaffold planks (8 foot), 12
- BB. Mortar boards, 6
- CC. Flat wooden wheelbarrow
- DD. Brick tongs, 2
- EE. Mortar tub
- FF. Modular rule
- GG. Framing square
- HH. Bevel square
- II. Trowel
- JJ. Hammer
- KK. Level, 4'
- LL. Brick set
- MM. Heavy-duty marking pencil
- NN. Soft hand brush
- OO. Plumb bob
- PP. Claw hammer
- QQ. Water hose, 50'
- RR. Canvases (12' x 12'), 3

JOB SHEET #2

II. Procedure

(NOTE: The procedure listed is to provide actual application of building a fireplace in a real situation. Instructors may make adjustments for a laboratory setting.)

- A. Lay out fireplace
- B. Construct the ash pit
- C. Lay out reinforced brick slab
- D. Construct a firebox using a 3' cast-iron damper and buttering firebrick with fireclay

(NOTE: Use procedures outlined in Job Sheet #1.)

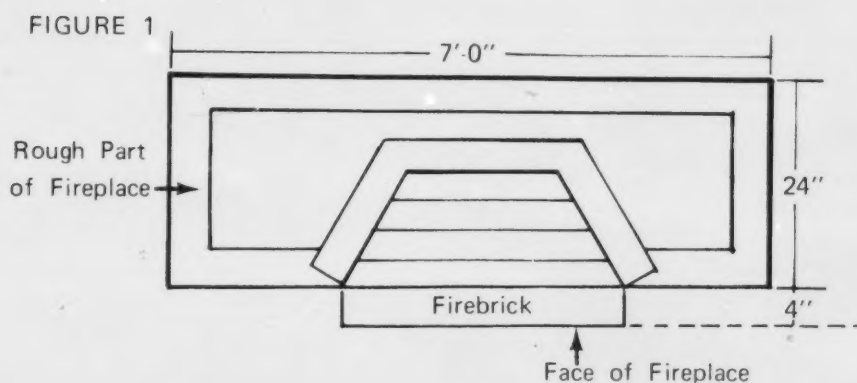
E. Complete rough part of fireplace

1. Start laying out the rough part of the fireplace when firebox is completed and damper is set

(NOTE: It is called the rough part of the fireplace because the exterior of the back, which is 7', and the ends, which are 24", will be concealed when the house or structure is completed.)

2. Lay course of brick that is below the floor
3. Lay first course of brick above floor

(NOTE: This will lay out rough part of the fireplace. See Figure 1.)



(Note: The rough part of the fireplace is kept back 4" from the face of the fireplace to allow enough space to build the finished face later.)

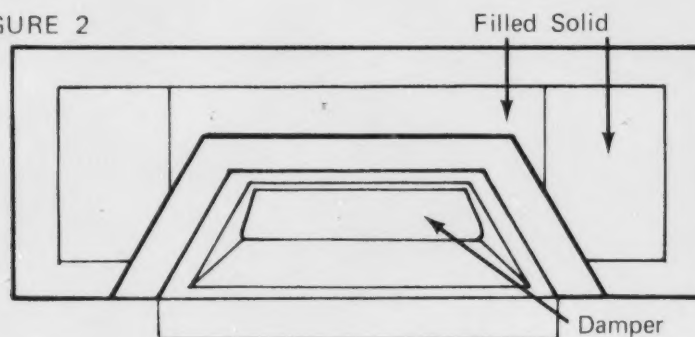
JOB SHEET #2

4. Continue to lay up the rough part of the fireplace to the top course of the firebox, laying brick to fill the space on both sides and the back of the firebox
5. Set light gauge metal ties in rough face spaced 16" horizontally and on the fifth and tenth course vertically for the finished face jambs and for bonding to rough fireplace

(NOTE: No jointing is required for the rough part of the fireplace. Keep all joints filled solid.)

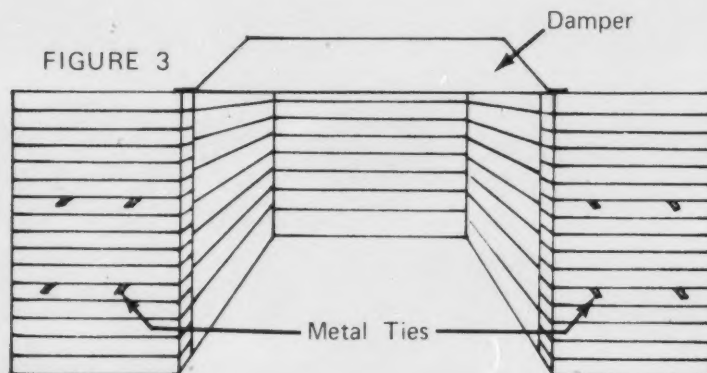
6. Smooth out the area between the back of the damper to the inside back of fireplace for smoke shelf using mortar (Figure 2)

FIGURE 2



(NOTE: The spaces on the sides of the firebox could be used for placing flue linings for boiler or fireplace in basement if specified. See Figure 3.)

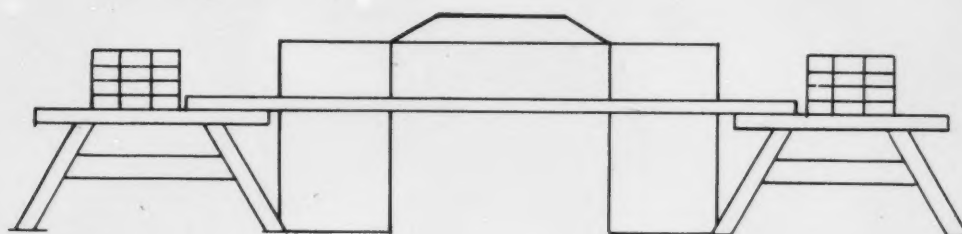
FIGURE 3



JOB SHEET #2

7. Build 2' high scaffold around fireplace for easy reaching and for laying out smoke chamber (Figure 4)

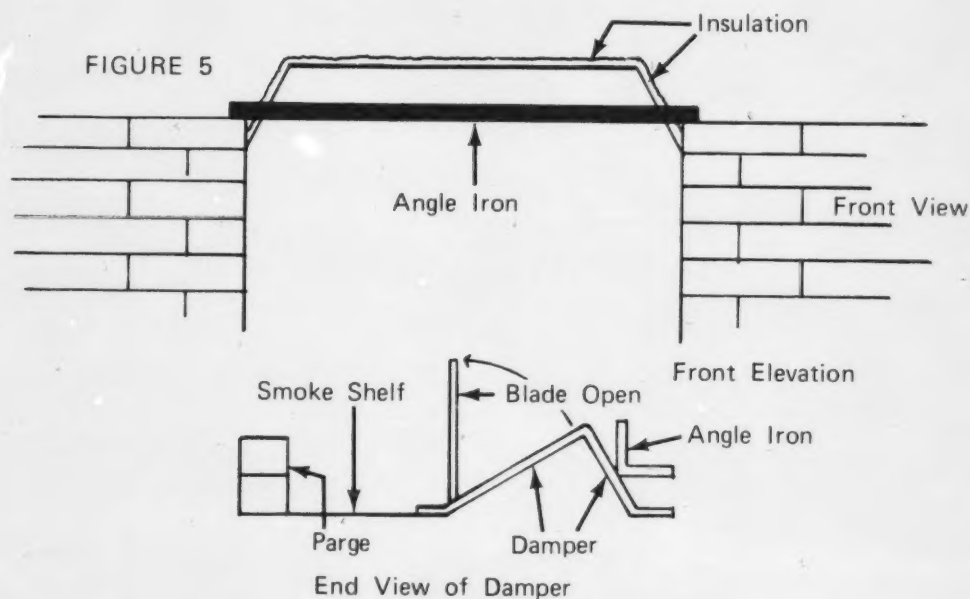
FIGURE 4



8. Lay three courses of brick at the back of the fireplace and both ends

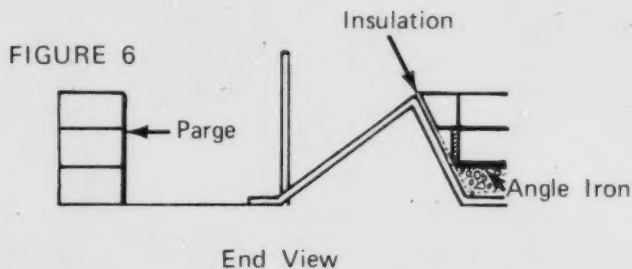
(NOTE: Place fireproof insulation at ends and front of damper so that you will have room for expansion of damper.)

9. Lay one course of brick on front side up to the ends of the damper, setting 3" x 3" x 1/4" x 3' 8" angle iron on top of first course (Figure 5)



JOB SHEET #2

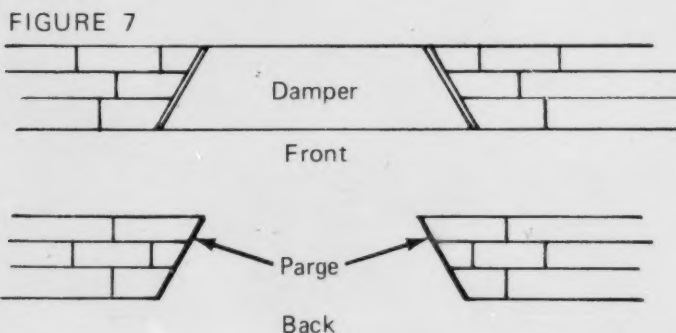
10. Lay two more courses of brick, cutting brick to fit on angle iron (Figure 6)



(NOTE: Cut brick on slant to meet face of damper.)

11. Lay three courses of brick on the inside to form the smoke chamber, cutting brick on slant to match the angle of the damper

(NOTE: These bricks are laid from front to back of fireplace wall. See Figure 7.)



(NOTE: Try to keep parging smooth so that air and smoke will travel smoothly.)

12. Check to make sure damper blade is clear for opening and closing before you start laying brick on the exterior walls of the rough fireplace

(NOTE: On most cast-iron dampers the blade can be removed.)

13. Remove blade and place it away from working area so that it will not get broken

JOB SHEET #2

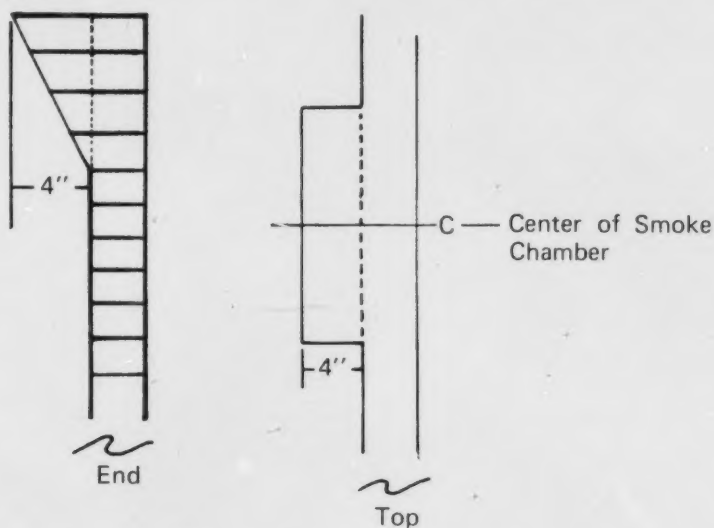
14. Use trowel to remove mortar that may have dropped on smoke shelf
15. Place a piece of heavy paper on smoke shelf
(NOTE: A clean empty cement bag works fine.)
16. Remove paper after smoke chamber has been completed and flue lining is set in position
17. Make sure the smoke shelf and the top edges of damper are cleaned
18. Replace damper blade

F. Lay brick for exterior walls

1. Lay seven courses of brick on exterior walls of rough fireplace, keeping joints filled solid

(NOTE: When laying brick on the front wall, you will have to cut brick for slant at smoke chamber for four courses so that part of the wall will meet the inside of the flue lining. See Figure 8.)

FIGURE 8

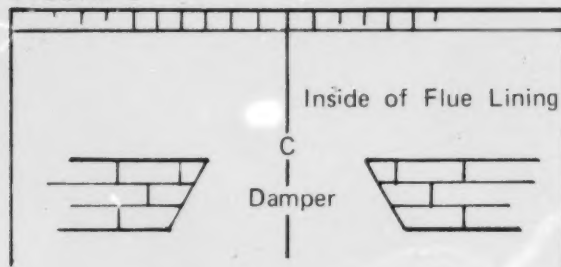


JOB SHEET #2

2. Mark the center of the smoke chamber and the inside measurement of flue lining with rule (Figure 9)

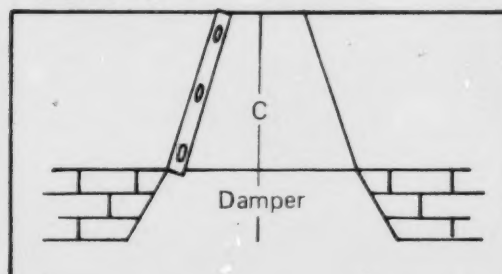
(NOTE: Do this on both sides.)

FIGURE 9



3. Draw line from mark for inside of flue lining to the part of the smoke chamber that has been started, using a level (Figure 10)

FIGURE 10



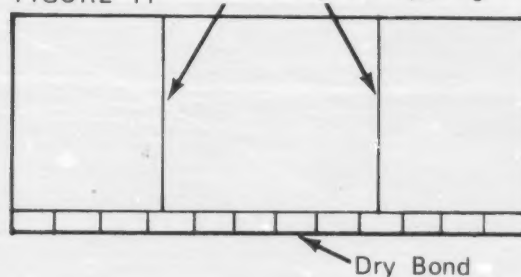
4. Lay brick courses for the smoke chamber, cutting brick to match lines that outline the inside of smoke chamber

(NOTE: Be sure to keep mortar joints filled solid to prevent any possible leaks. This part of the fireplace is one of the most important. Make sure to parge the smoke chamber walls to keep them smooth and to insure against possible leaks.)

JOB SHEET #2

- G. Install flue liner
- H. Build the chimney
- I. Finish the face of fireplace
 - 1. Lay out finished face of fireplace using the dry bond method for brick and making sure to lay dry bond through fireplace opening (Figure 11)

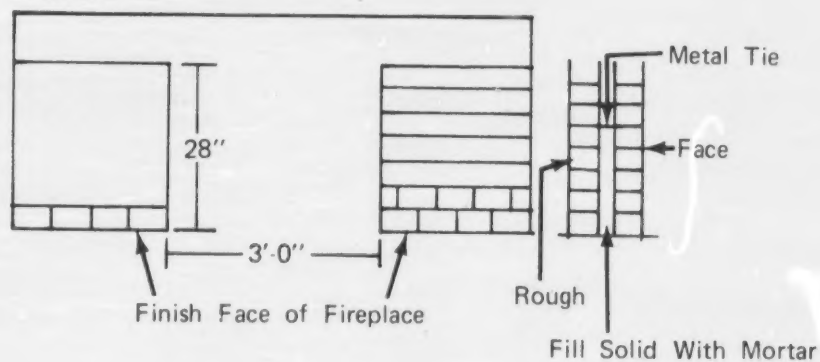
FIGURE 11 Finish Fireplace Opening



- 2. Lay up the fireplace jambs to a height of 28"

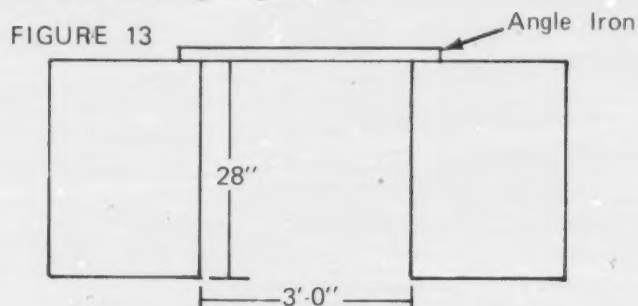
(NOTE: Make sure to bond face brick to rough using the metal ties that were set in the rough part of the fireplace. Keep joint filled solid at the back of finished face. Using round jointer, joint the two jambs. See Figure 12.)

FIGURE 12

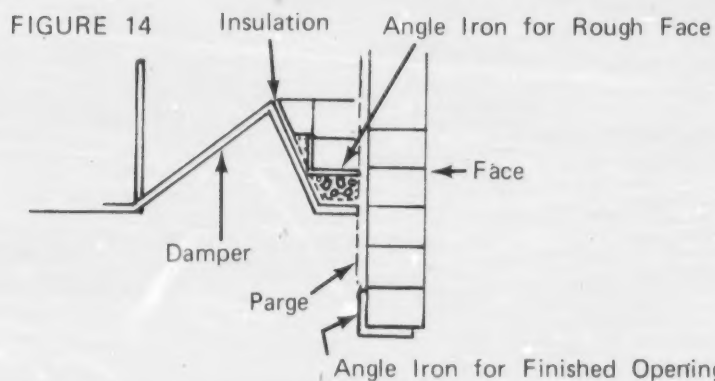


JOB SHEET #2

3. Set 3 1/2" x 2 1/2" x 1/4" x 4' piece of angle iron to cover finished opening (Figure 13)

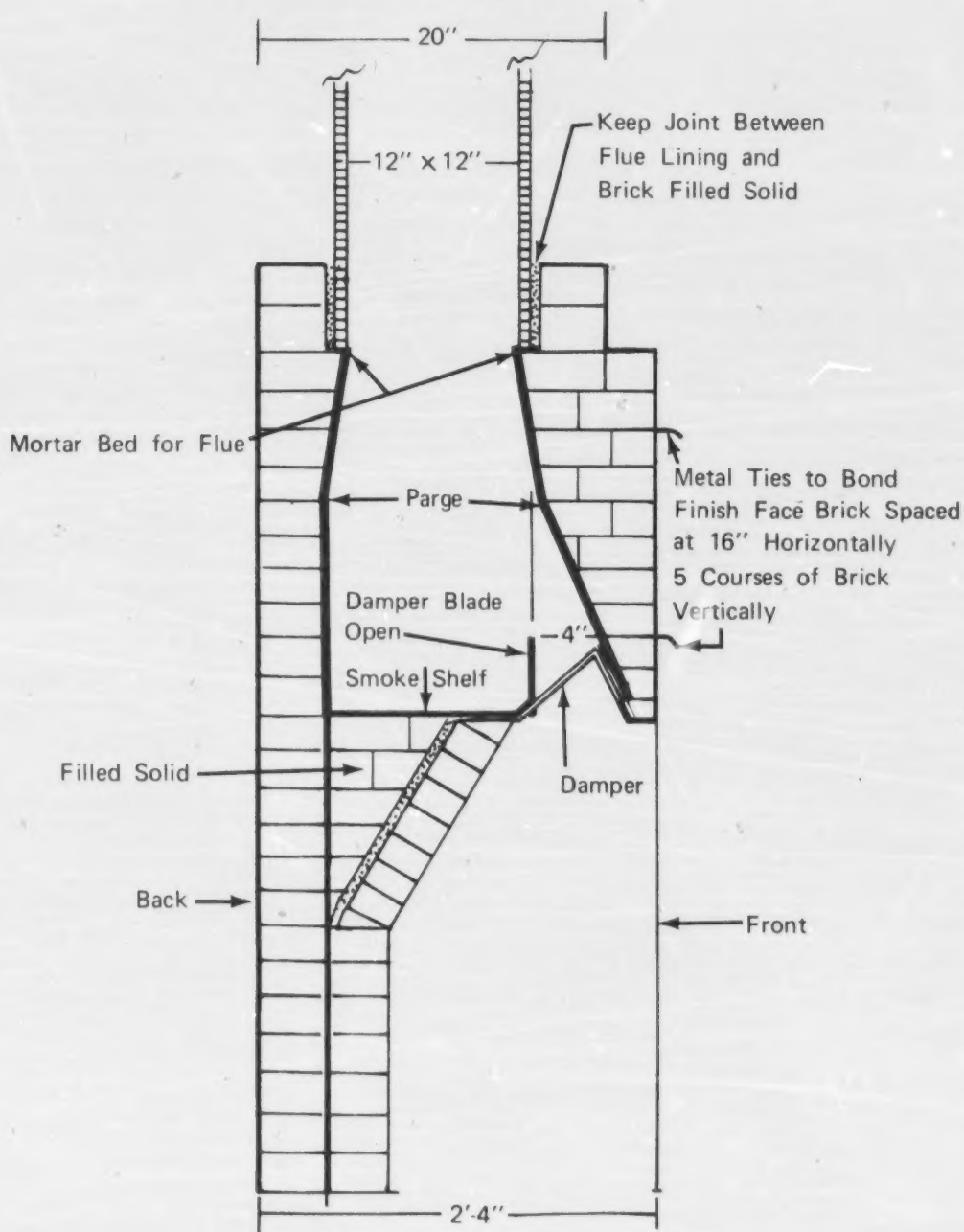


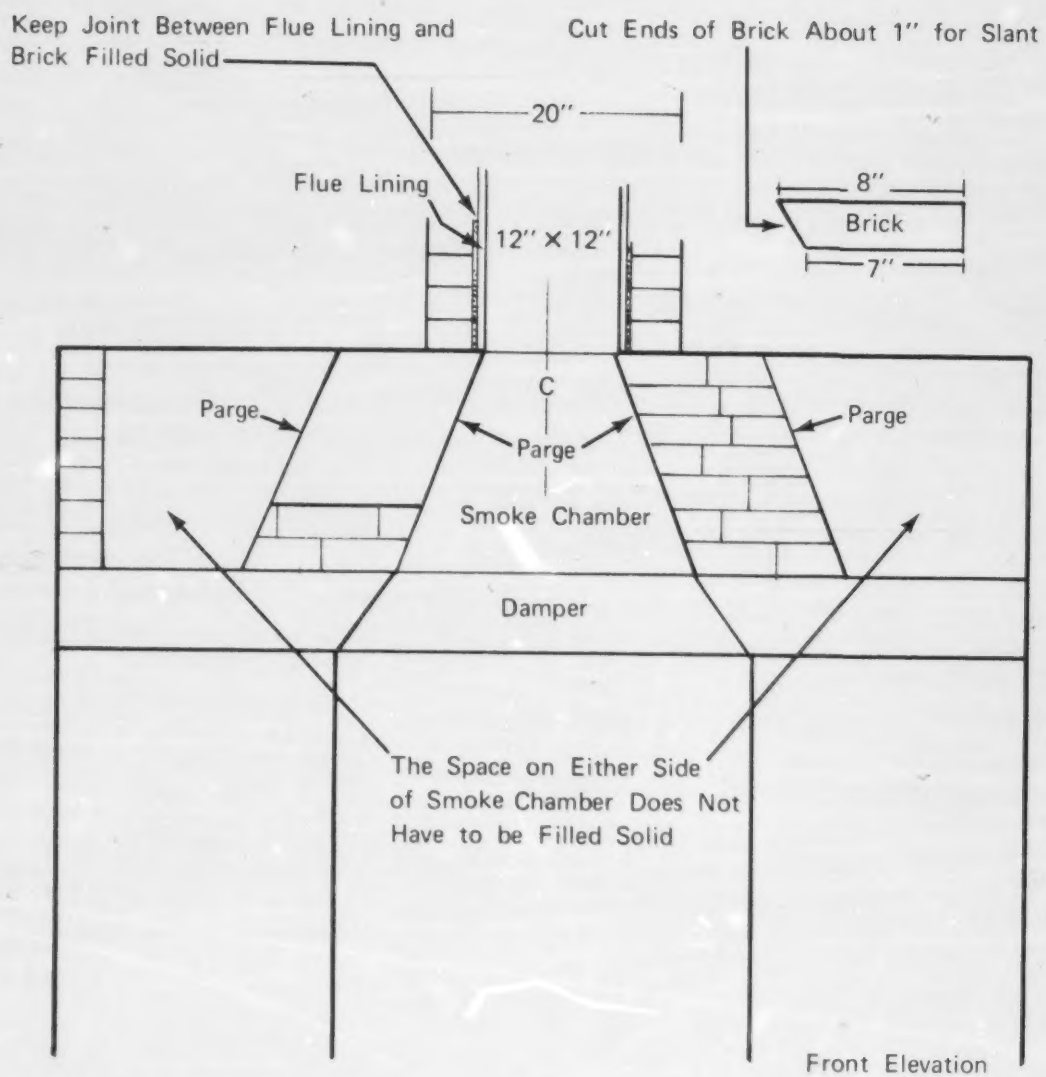
4. Continue to lay up the remainder of the finished face of fireplace
5. Parge the backside from the top of angle iron to the underside of damper (Figure 14)



(NOTE: Fill space between damper and back side of face with pieces of brick and mortar, keeping pieces tight to the underside of angle.)

End View
Section Through Center of Smoke Chamber





CHIMNEYS AND FIREPLACES

UNIT III

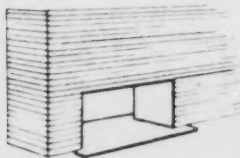
TEST

1. Match the terms on the right to the correct definitions. (Definitions are continued on the next page.)

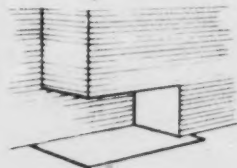
- | | |
|---|---------------------------|
| _____ a. Thin material placed in mortar joints and through air spaces in masonry to prevent water penetration and/or provide water drainage | 1. Firestop |
| _____ b. Shelf or ledge formed by projecting successive courses of masonry out from the face of the wall | 2. Mantle |
| _____ c. Brick made of refractory ceramic material which will resist high temperatures | 3. Damper |
| _____ d. Passage in a chimney especially for the exit of smoke and gases, one or more of which may be enclosed in the same chimney | 4. Cap |
| _____ e. Shelf projecting beyond the face of the fireplace | 5. Firebrick |
| _____ f. Metal frame with adjustable door that sits on top of firebrick of the combustion chamber | 6. Brick outer hearth |
| _____ g. Metal door set in brick on the floor of the firebox or combustion chamber for dumping ashes into ash pit | 7. Cleanout door |
| _____ h. Space in a fireplace immediately above the throat where the smoke gathers before passing into the flue; narrowed by cutting brick and parging to the size of the flue lining above | 8. Flashing |
| _____ i. Projection of brickwork on the walls between the joist to prevent the spread of fire | 9. Smoke shelf |
| _____ j. Reinforced piece of concrete at top of chimney | 10. Reinforced brick slab |
| | 11. Corbel |
| | 12. Ash dump |
| | 13. Refractory |
| | 14. Flue lining |
| | 15. Smoke chamber |
| | 16. Breast |
| | 17. Throat |

- _____ k. Shelf directly in back of throat of damper; prevents downdraft
- _____ l. Metal-framed door used to clean out ashes
- _____ m. Brick slab that covers the entire top of the ash pit and extends out to receive outer hearth
- _____ n. Brick or tile floor that extends out from the face of the fireplace and the full length of the fireplace
- _____ o. Any brick which is especially made to withstand the effects of high heat without fusion
- _____ p. That part of the fireplace above the jambs and opening
- _____ q. Opening at the top of a fireplace through which the smoke passes to the smoke chamber and chimney

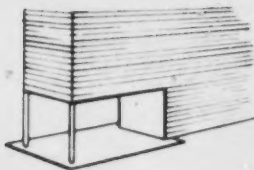
2. Identify the types of fireplaces below by writing the correct names in the blanks.



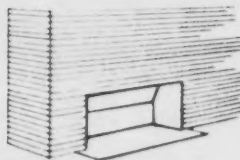
a. _____



b. _____

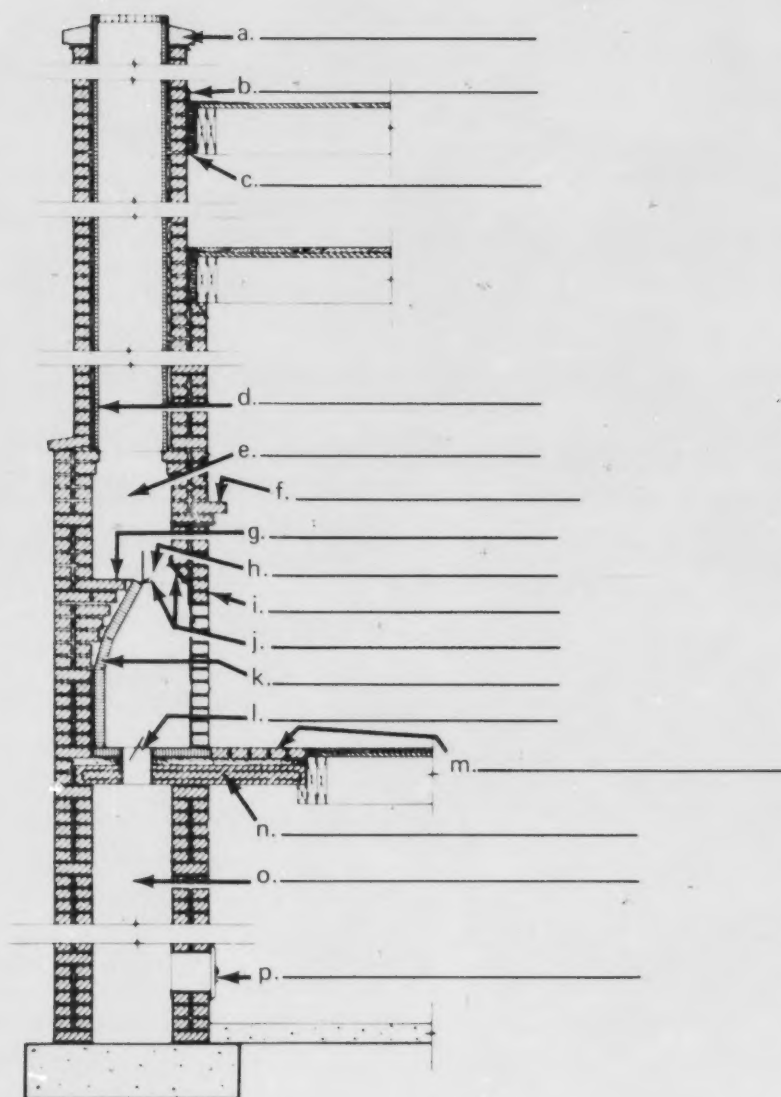


c. _____



d. _____

3. Identify the parts of the fireplace below by writing the correct names in the blanks provided.



4. Select from the list below the proper factors to consider in constructing fireplaces and chimneys by placing an "X" in the correct blanks.

- ☐ a. Chimney should be one foot six inches above highest point of roof
- ☐ b. Fireplace should be laid out on first floor
- ☐ c. Brickwork below the fireplace is the same perimeter as the fireplace
- ☐ d. Bottom of damper should be six to eight inches below the top of finished opening
- ☐ e. The size of damper specified is the finished fireplace opening
- ☐ f. Finished opening height should be less than the width of finished opening of fireplace
- ☐ g. Chimney should be three feet above the highest point where it passes through the roof of a building and at least two feet higher than any portion of the building within ten feet
- ☐ h. Bottom of damper should be six to eight inches above the top of finished opening
- ☐ i. Smoke shelf should be kept level with bottom of damper
- ☐ j. Damper should be measured at bottom of inside for fireplace opening and sides of firebox

5. Discuss in a short paragraph the procedure for buttering a firebrick.

6. Distinguish between firebrick mortar and brick mortar by placing an "F" before the characteristics of firebrick mortar and a "B" before those of brick mortar.
- ☐ a. Withstands intensive heat
 - ☐ b. Contains cement, lime, sand, and water
 - ☐ c. Is very plastic
 - ☐ d. Does not require sand
 - ☐ e. Will resist rain after hardening
 - ☐ f. Cannot be used on exterior
 - ☐ g. Is used for bonding brick and block
 - ☐ h. Can be used on interior or exterior
7. Name the three characteristics of firebrick.
- a.
 - b.
 - c.
8. Select from the list below the proper characteristics of a firebox by placing an "X" in the blanks provided.
- ☐ a. The slope of the back throws the heat upward
 - ☐ b. The slope of the back throws the flame forward and leads the gases through the throat with increasing velocity
 - ☐ c. The angle of the sides reduces the maximum radiation of heat into the room
 - ☐ d. The angle of the sides gives maximum radiation of heat into the room
9. Demonstrate the ability to:
- a. Construct a firebox.
 - b. Construct a fireplace.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

CHIMNEYS AND FIREPLACES
UNIT III

ANSWERS TO TEST

- | | | | | | | |
|----|----|----|----|----|----|----|
| 1. | a. | 8 | g. | 12 | m. | 10 |
| | b. | 11 | h. | 15 | n. | 6 |
| | c. | 5 | i. | 1 | o. | 13 |
| | d. | 14 | j. | 4 | p. | 16 |
| | e. | 2 | k. | 9 | q. | 17 |
| | f. | 3 | l. | 7 | | |
- 2.
- a. Two face (opposite)
 - b. Two face (adjacent)
 - c. Three face (2 long, 1 short)
 - d. Single face
- 3.
- a. Cap
 - b. Flashing
 - c. Firestop
 - d. Flue lining
 - e. Smoke chamber
 - f. Mantle
 - g. Smoke shelf
 - h. Throat
 - i. Breast
 - j. Damper
 - k. Firebrick
 - l. Ash dump
 - m. Brick outer hearth

- n. Reinforced brick slab
- o. Ash pit
- p. Cleanout door
- 4. b, c, e, f, g, h, i, j
- 5. Discussion should include:
 - a. Do not wet firebrick
 - b. Mix fireclay so that it will have a consistency of heavy whipped cream
 - c. Butter firebrick with trowel
- 6.

a. F	e. B
b. B	f. F
c. F	g. B
d. F	h. B
- 7.
 - a. Larger in size than regular brick
 - b. Resistant to high temperatures
 - c. Sensitive to moisture and cold
- 8. b, d
- 9. Performance skills evaluated to satisfaction of the instructor

CUT STONE UNIT IV

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list types of stone, describe procedures for layout and bonding, and list precautions to observe when handling and storing stone. The student should be able to list factors to consider when setting stone and identify methods of handling stone. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with cut stone to the correct definitions.
2. Select from a list purposes of using cut stone.
3. List types of stone.
4. Describe the procedure for laying out stone.
5. Discuss procedures for bonding stone.
6. Select from a list types of anchors used in setting stone.
7. List reasons for installing flashing.
8. Select from a list reasons for using insulation.
9. List factors to consider in protecting the stone during construction.
10. Select from a list reasons for using expansion and control joints.
11. Name types of expansion and control joints.
12. List precautions to observe when unloading and storing stone.
13. List factors to consider when setting stone.
14. Identify methods of handling stone.
15. Name equipment used in lifting stone.

CUT STONE
UNIT IV

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparency.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Provide student with chance to see jobs where stone was used.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency master: TM 1--Methods of Handling Stone
- D. Test
- E. Answers to test

II. References:

- A. *Indiana Limestone Handbook*. Bloomington, Indiana: Indiana Limestone Institute, 1963.
- B. Dalzell, J. Ralph, and Townsend, Gilbert. *Masonry Simplified*. Vol. 1. Chicago: American Technical Society, 1956.
- C. *Technical Notes on Brick Construction*. McLean, Virginia: Brick Institute of America, 1973.

CUT STONE
UNIT IV

INFORMATION SHEET

I. Terms and definitions

- A. Cut stone--Blocks of stone cut to specified dimensions
- B. Lewis holes--Holes drilled at an angle on top of stone that cannot be handled manually so that the stone can be picked up using lewis pins and lifting equipment
- C. Control joint--Continuous vertical joints built into concrete, brick, and block walls to control cracking resulting from unusual stress

(NOTE: The joints are intended to permit slight wall movement without cracking.)
- D. Expansion joint--Vertical joint or space to allow for temperature changes
- E. Spall--Chip or small piece of stone broken from a large block
- F. Pilaster--Wall portion projecting from either or both wall faces and serving as a vertical column
- G. Pointing--Filling the joints
- H. Limestone--Composed largely of calcium carbonate originating usually from an accumulation of organic remains, such as shells, which yield lime when burned

(NOTE: This stone is also used extensively as a source of lime.)

- I. Choker--Rope used to lift stone

II. Purposes of using cut stone

- A. Architectural design
- B. Appearance
- C. Decoration

III. Types of stone

- A. Limestone
- B. Sandstone

INFORMATION SHEET

C. Granite

D. Slate

IV. Procedure for laying out stone

A. Unload stone

B. Keep stone clear of ground

(NOTE: Stone can be set on the same material on which it was delivered.)

C. Check each unloaded stone for damage

(NOTE: Keep record of damages and report to the deliverer when unloading is complete.)

D. Set stone with lewis holes so the holes will be facing upward if possible but care should be taken so finished stone areas will not be damaged

(NOTE: This will aid in moving stone to final setting.)

E. Protect cornice and projecting stone with nonstaining pads and blocking materials so that stone will not tip over

F. Store stone in sequence in which it is to be set

G. Cover stone with a waterproof, nonstaining material

H. Set stone in final setting accurately in strict accordance with contract and shop drawings

(NOTE: Shop drawing will contain all details for final setting.)

V. Procedure for bonding stone

A. Bond stone with nonstaining mortar

(NOTE: White mortar is generally used as bonding material.)

B. Clean stone thoroughly with soap and water

(NOTE: A scrub brush may be used.)

C. Drench with clean water

D. Use anchors specified

E. Set slip sills on full bed of mortar

INFORMATION SHEET

- F. Set lug sills with mortar beds at ends only

(NOTE: To set sills, use a soft wood wedge soaked in water to provide tilt of sill.)

VI. Types of anchors used in setting stone

(NOTE: All anchors should be noncorrosive, such as galvanized or stainless steel.)

- A. Strap anchor
- B. Cramp anchor
- C. Corrugated wall tie
- D. Strap anchor and dowel
- E. Corrugated dovetail anchor
- F. Two-way dovetail anchor

VII. Reasons for installing flashing

- A. Collects moisture that may enter the wall cavity and carries it to the outside
- B. Prevents staining
- C. Prevents water penetration

VIII. Reasons for using insulation

- A. Reduces heating and cooling costs
- B. Improves fire resistance
- C. Reduces sound transmission
- D. Increases year-round comfort

IX. Protection of stone during construction

- A. Cover tops of walls when stopping work
- B. Keep walls covered during bad weather
- C. Keep walls adequately protected from heavy rains

(NOTE: Wall covers should be waterproof and made of nonstaining materials.)

- D. Cover sills and other horizontal courses with nonstaining wooden coverings

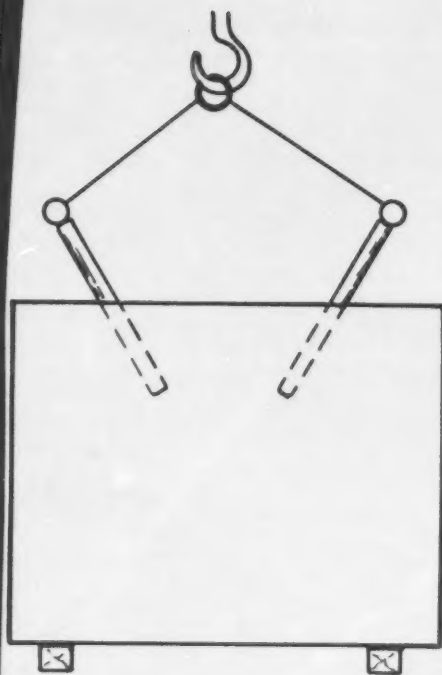
INFORMATION SHEET

- X. Reasons for using expansion and control joints
 - A. Allow for expansion and contraction of concrete
 - B. Allow for expansion and contraction of steel
 - C. Allow for differential movement between the building frame and walls due to thermal changes
 - D. Prevent spalling of stone
 - E. Prevent cracking
- XI. Types of expansion and control joints
 - A. Expansion joint for exterior walls
 - B. Expansion joint for columns
 - C. Expansion joint for pilasters
 - D. Pressure-relieving joint
- XII. Precautions to observe when unloading and storing stone
 - A. Use the same spacing material that was delivered with stone
 - B. Place stones with lewis holes, if any, facing upward
(NOTE: Special care should be taken when storing cornice and projecting stone.)
 - C. Keep stones well protected with padding material when using stone straps or rope chokers
 - D. Unload stone at the elevation that stone will be used
(NOTE: Others may be added by instructor.)
- XIII. Factors to consider when setting stone
 - A. Wash stone thoroughly with brush, soap, and water
 - B. Rinse thoroughly with clean water
 - C. Use nonstaining cement for setting, grouting, and parging
(NOTE: Use dry oakum for caulking joints that are to be grouted.)
 - D. Use soft wood wedges soaked in water
 - E. Set stone level, plumb, square, and true with uniform joints

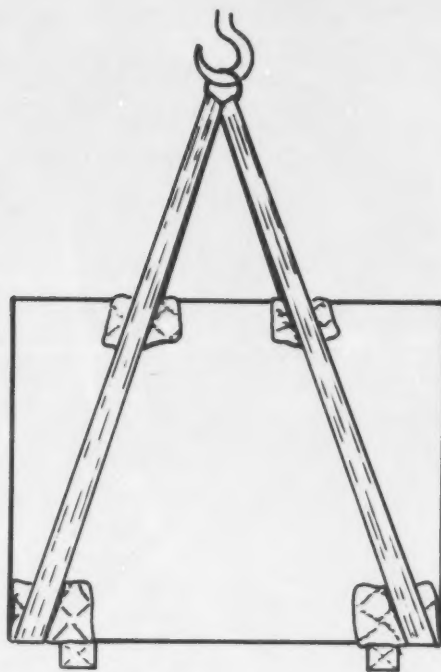
INFORMATION SHEET

- F. Rake out all face joints $\frac{3}{4}$ " for pointing at completion of setting all stone
 - G. Keep faces of stone clean after setting by washing with sponge or brush and water
 - H. Set limestone accurately in strict accordance with contract and shop drawings
- XIV. Methods of handling stone (Transparency 1)
- A. Lewis pins
 - B. Straps
 - C. Rope chokers
- XV. Equipment used in lifting stone
- A. Crane
 - B. Gin poles
 - C. German jack (hand operated)
 - D. Chain falls (hand operated)

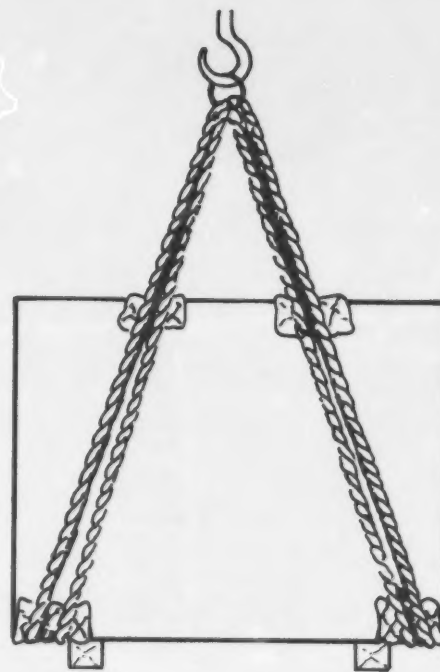
Methods of Handling Stone



Lewis Pins



Straps



Rope Chokers

CUT STONE UNIT IV

TEST

1. Match terms on the right to the correct definitions.

_____ a. Chip or small piece of stone broken from a large block	1. Cut stone
_____ b. Filling the joints	2. Lewis holes
_____ c. Continuous vertical joints built into concrete, brick, and block walls to control cracking resulting from unusual stress	3. Control joint
_____ d. Blocks of stone cut to specified dimensions	4. Expansion joint
_____ e. Rope used to lift stone	5. Spall
_____ f. Vertical joint or space to allow for temperature changes	6. Pilaster
_____ g. Holes drilled at an angle on top of stone that cannot be handled manually so that the stone can be picked up using lewis pins and lifting equipment	7. Pointing
_____ h. Composed largely of calcium carbonate originating usually from an accumulation of organic remains, such as shells, which yield lime when burned	8. Limestone
_____ i. Wall portion projecting from either or both wall faces and serving as a vertical column	9. Choker

2. Select from the list below purposes of using cut stone by placing an "X" in the correct blanks.

_____ a. Texture
_____ b. Architectural design
_____ c. Appearance
_____ d. Decoration
_____ e. Water tightness

3. List four types of stone.
 - a.
 - b.
 - c.
 - d.
4. Describe the procedure for laying out stone.
5. Discuss procedures for bonding stone.

6. Select from the list below types of anchors used in setting stone by placing an "X" in the blanks provided.

_____ a. Strap anchor
_____ b. Cramp anchor
_____ c. Corrugated wall tie
_____ d. Strap anchor and dowel
_____ e. Corrugated dovetail anchor
_____ f. Two-way dovetail anchor
_____ g. Aluminum wall anchor

7. List three reasons for installing flashing.

a.
b.
c.

8. Select from the list below reasons for using insulation by placing an "X" in the blanks provided.

_____ a. Reduces heating and cooling costs
_____ b. Improves fire resistance
_____ c. Prevents mildew
_____ d. Reduces sound transmission
_____ e. Increases year-round comfort

9. List two factors to consider in protecting the stone during construction.

a.
b.

10. Select from the list below reasons for using expansion and control joints by placing an "X" in the blanks provided.

- ☐ a. Allow for expansion and contraction of concrete
- ☐ b. Allow for expansion and contraction of steel
- ☐ c. Allow for differential movement between the building frame and walls due to thermal changes
- ☐ d. Beautify
- ☐ e. Prevent spalling of stone
- ☐ f. Prevent cracking

11. Name types of expansion and control joints.

- a.
- b.
- c.
- d.

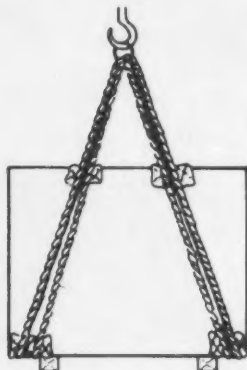
12. List three safety precautions to observe when unloading and storing stone.

- a.
- b.
- c.

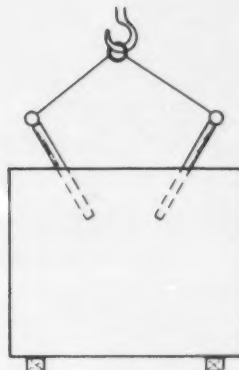
13. List four factors to consider when setting stone.

- a.
- b.
- c.
- d.

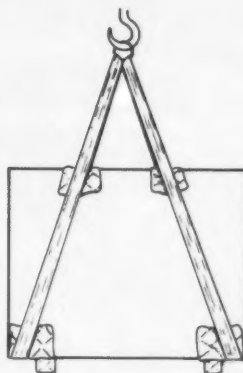
14. Identify the following methods of handling stone by writing the correct names in the blanks.



a. _____



b. _____



c. _____

15. Name four pieces of equipment used in lifting stone.

a.

b.

c.

d.

CUT STONE
UNIT IV

ANSWERS TO TEST

1.
 - a. 5
 - b. 7
 - c. 3
 - d. 1
 - e. 9
 - f. 4
 - g. 2
 - h. 8
 - i. 6
2. b, c, d
3.
 - a. Limestone
 - b. Sandstone
 - c. Granite
 - d. Slate
4. Description should include:
 - a. Unload stone
 - b. Keep stone clear of ground
 - c. Check each unloaded stone for damage
 - d. Set stone with lewis holes so the holes will be facing upward if possible but care should be taken so finished stone areas will not be damaged
 - e. Protect cornice and projecting stone with nonstaining pads and blocking materials so that stone will not tip over
 - f. Store stone in sequence in which it is to be set
 - g. Cover stone with a waterproof, nonstaining material
 - h. Set stone in final setting accurately in strict accordance with contract and shop drawings
5. Discussion should include:
 - a. Bond stone with nonstaining mortar
 - b. Clean stone thoroughly with soap and water
 - c. Drench with clean water
 - d. Use anchors specified

- e. Set slip sills on full bed of mortar
- f. Set lug sills with mortar beds at ends only
- 6. a, b, c, d, e, f
- 7. a. Collects moisture that may enter the wall cavity and carries it to the outside
- b. Prevents staining
- c. Prevents water penetration
- 8. a, b, d, e
- 9. Any two of the following:
 - a. Cover tops of walls when stopping work
 - b. Keep walls covered during bad weather
 - c. Keep walls adequately protected from heavy rains
 - d. Cover sills and other horizontal courses with nonstaining wooden coverings
- 10. a, b, c, e, f
- 11. a. Expansion joint for exterior walls
- b. Expansion joint for columns
- c. Expansion joint for pilasters
- d. Pressure-relieving joint
- 12. Any three of the following:
 - a. Use the same spacing material that was delivered with stone
 - b. Place stones with lewis holes, if any, facing upward
 - c. Keep stones well protected with padding material when using stone straps or rope chokers
 - d. Unload stone at the elevation that stone will be used
 - e. Others that were added by instructor
- 13. Any four of the following:
 - a. Wash stone thoroughly with brush, soap, and water
 - b. Rinse thoroughly with clean water

- c. Use nonstaining cement for setting, grouting, and parging
 - d. Use soft wood wedges soaked in water
 - e. Set stone level, plumb, square, and true with uniform joints
 - f. Rake out all face joints $\frac{3}{4}$ " for pointing at completion of setting all stone
 - g. Keep faces of stone clean after setting by washing with sponge or brush and water
 - h. Set limestone accurately in strict accordance with contract and shop drawings
- 14.
- a. Rope chokers
 - b. Lewis pins
 - c. Straps
- 15.
- a. Crane
 - b. Gin poles
 - c. German jack (hand operated)
 - d. Chain falls (hand operated)

RELATED LAYOUT AND CONSTRUCTION UNIT V

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list purposes of various kinds of related layout and construction, identify types of different materials used, and describe procedures for erecting various kinds of materials. This knowledge will be evidenced by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with related layout and construction to the correct definitions.
2. State the purposes of arches in brick construction.
3. Identify types of arches.
4. List purposes of masonry paving.
5. Identify types of paving patterns.
6. List purposes of using glazed structural tile.
7. Identify types of structural tile.
8. List purposes of precast panels.
9. Name types of precast panels.
10. Describe procedure for erecting panels or prefab units.
11. Select from a list purposes of prefab units.
12. Name types of prefab units.
13. State the purposes of grouting.
14. Name types of grouting.
15. List factors to consider when building cavity walls.
16. Match sizes of reinforcement bars to the correct numbers of bars.
17. Select from a list purposes of insulation.
18. Name methods of applying insulation.

RELATED LAYOUT AND CONSTRUCTION
UNIT V

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information sheet.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Provide student with opportunity to see jobs using various kinds of related construction materials.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Types of Arches
 - 2. TM 2--Types of Paving Patterns
 - 3. TM 3--Types of Structural Tile
 - 4. TM 4--Types of Precast Panels

5. TM 5--Types of Precast Panels (Continued)
6. TM 6--Grouting
7. TM 7--Grouting (Continued)
8. TM 8--Cavity Walls
9. TM 9--Insulation
10. TM 10--Insulation (Continued)

D. Test

E. Answers to test

II. References:

- A. *Technical Notes on Brick and Tile Construction*. McLean, Virginia: Brick Institute of America.
- B. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.

RELATED LAYOUT AND CONSTRUCTION
UNIT V

INFORMATION SHEET

I. Terms and definitions

- A. Arch--Curved, compressive, structural member spanning openings or recesses; also built flat
- B. Precast concrete--Any concrete member that is cast in forms at a place other than its final position of use
- C. Prefab units--Masonry construction manufactured in a location other than its final inservice location in the structure

(NOTE: Also known as preassembled, panelized, and sectionalized brick masonry.)

- D. Grout--Mixture of cement material and aggregate to which sufficient water is added to produce a pouring consistency without segregation of the constituents
- E. Insulation--Any material used in building construction for the reduction of fire hazard or for protection from heat or cold
- F. Reinforcement--Concrete masonry in which steel reinforcement is embedded so that the two materials act together in resisting forces
- G. Wythe--Each continuous vertical section of masonry one unit in thickness

II. Purposes of arches in brick construction

- A. Used to bridge or span an opening
- B. Used to sustain weight

III. Types of arches (Transparency 1)

- A. Jack
- B. Segmental
- C. Multicentered
- D. Tudor

INFORMATION SHEET

- E. Roman or semicircular
- F. Gothic
- G. Parabolic
- IV. Purposes of masonry paving
 - A. Adds color
 - B. Provides durable wearing surface
 - C. Adds to appearance and economy
 - D. Can be placed in a bed of mortar and with mortar joints
 - E. Can be placed without using mortar
 - F. May be used for interior or exterior
 - G. May be used for patios, walks, steps, and brick screens
- V. Types of paving patterns (Transparency 2)
 - A. Basket weave
 - B. Herringbone
 - C. Running bond
 - D. Basket weave variations
 - (NOTE: There are several variations of the basket weave.)
 - E. 1/4 running bond
 - F. Running and stack bond mixed
 - G. Stack bond
 - H. Circular and running bond mixed
- VI. Purposes of using glazed structural tile
 - A. Easily cleaned
 - B. Stain resistant
 - C. Very low maintenance
 - D. Range of light and dark colors

INFORMATION SHEET

VII. Types of structural tile (Transparency 3)

- A. Stretcher
- B. Bull nose (B.N.)
- C. Cove corner
- D. Cove base
- E. Sill
- F. Cap

(NOTE: Structural tiles come in many shapes and sizes.)

VIII. Purposes of precast panels

- A. Panels constructed before need arises
- B. Fast construction
- C. Maximum job efficiency

(NOTE: Craftsman can put in more man hours since weather is not a hinderance.)

IX. Types of precast panels (Transparencies 4 and 5)

- A. Concrete slabs precast on ground at job site
- B. Precast slabs made at off-site plant
- C. Prestressed tees made at off-site plant
- D. Prestressed concrete plank
- E. Prefabricated brick panel

(NOTE: These panels may be made on site or at off-site plant.)

X. Procedure for erecting panels and prefab units

- A. Work from contract and shop drawings for panel identification
- B. Check for tolerances of building frame and panel erection
- C. Check joint size and treatment
- D. Coordinate panels with other trades
- E. Weld, bolt, or anchor panels to structure

INFORMATION SHEET

XI. Purposes of prefab units

- A. Constructed before needed
- B. Assembly line construction
- C. Speed and economy
- D. Less scaffolding
- E. Minimum maintenance
- F. Fire resistant
- G. Maximum job efficiency

(NOTE: Prefabrication of brick panels in a factory setup allows for year-round employment for the bricklayer.)

XII. Types of prefab units

- A. Reinforced concrete panels
- B. Reinforced brick panels
- C. Reinforced masonry unit panels

XIII. Purposes of grouting (Transparencies 6 and 7)

- A. Used where greater strength is required
- B. Acts to resist forces
- C. Used to fill cores in hollow block and the empty space between wythes in masonry walls

XIV. Types of grouting

- A. Mortar
- B. Fine grout
- C. Coarse grout

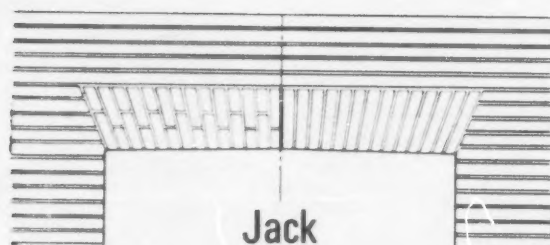
XV. Factors to consider when building cavity walls (Transparency 8)

- A. Install flashing at base of wall
- B. Install weep holes every 24 to 32 inches

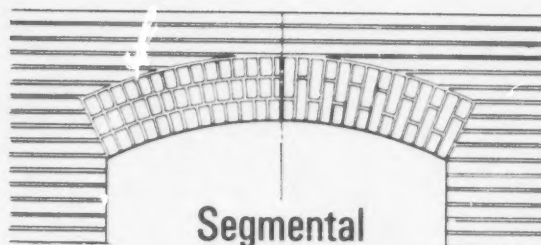
INFORMATION SHEET

- C. Do not drop mortar in cavity
 - D. Bevel mortar bed joints
 - E. Use proper ties
- XVI. Numbers and sizes of reinforcement bars
- A. #2-1/4" diameter
 - B. #3-3/8" diameter
 - C. #4-1/2" diameter
 - D. #5-5/8" diameter
 - E. #6-3/4" diameter
 - F. #7-7/8" diameter
 - G. #8-1" diameter
 - H. #9-1 1/8" diameter
- XVII. Purposes of insulation
- A. Conserve energy
 - B. Reduce cost of heating and cooling
 - C. Minimize heat flow through walls, floors, and roofs
 - D. Reduce sound transmission
 - E. Increase year-round comfort
- XVIII. Methods of applying insulation (Transparencies 9 and 10)
- A. Insulation poured into cores and cavities in masonry walls
 - B. Individual block insulation
 - C. Rigid insulation applied with adhesive
 - D. Rigid insulation applied with adjustable wall ties

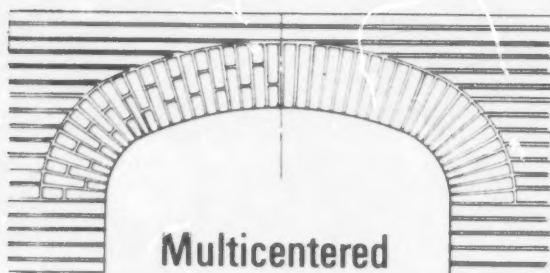
Types of Arches



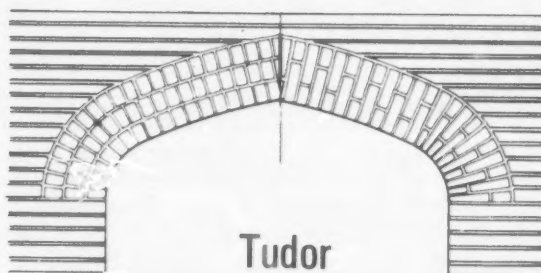
Jack



Segmental



Multicentered



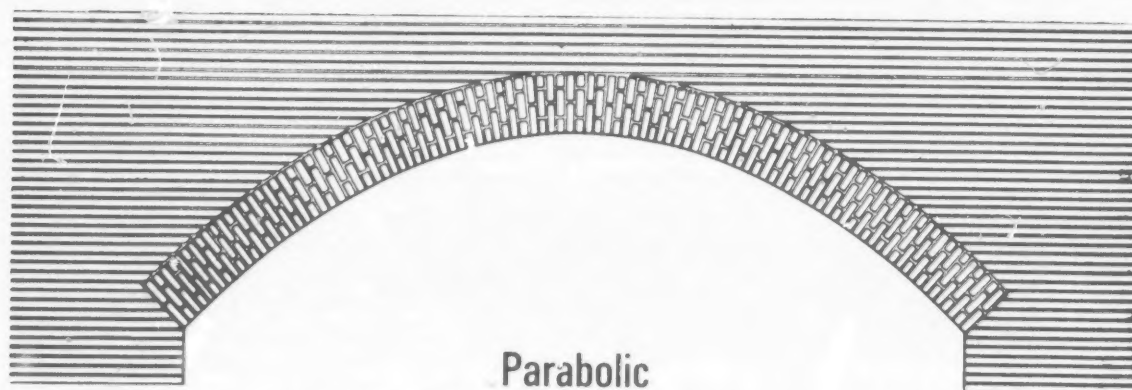
Tudor



Roman or
Semicircular

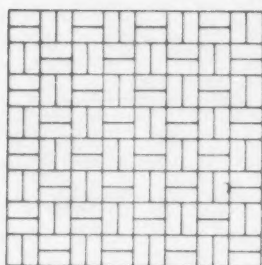


Gothic

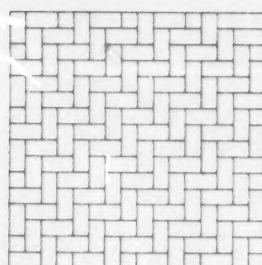


Parabolic

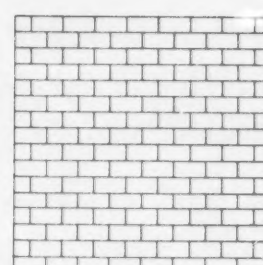
Types of Paving Patterns



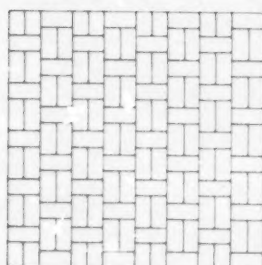
Basket Weave



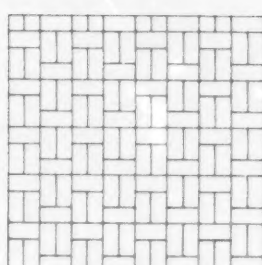
Herringbone



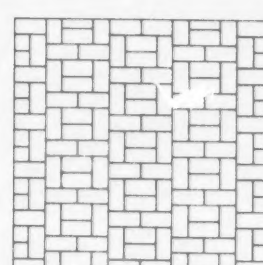
Running Bond



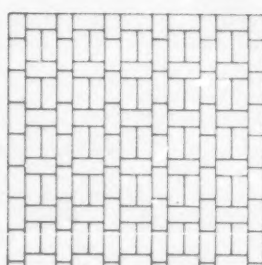
**Variation of
Basket Weave**



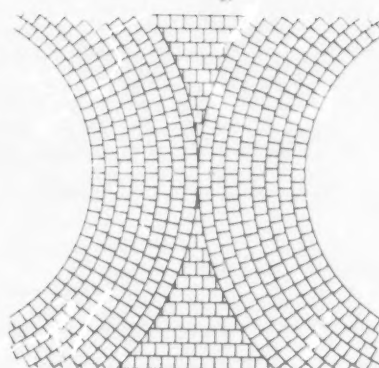
**Variation of
Basket Weave**



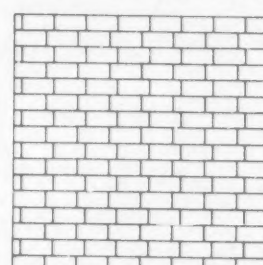
**Variation of
Basket Weave**



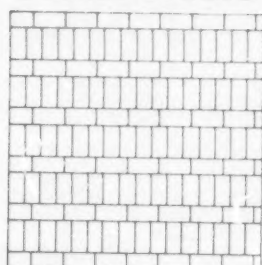
**Variation of
Basket Weave**



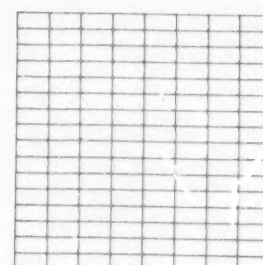
**Circular and Running
Bond Mixed**



1/4 Running Bond

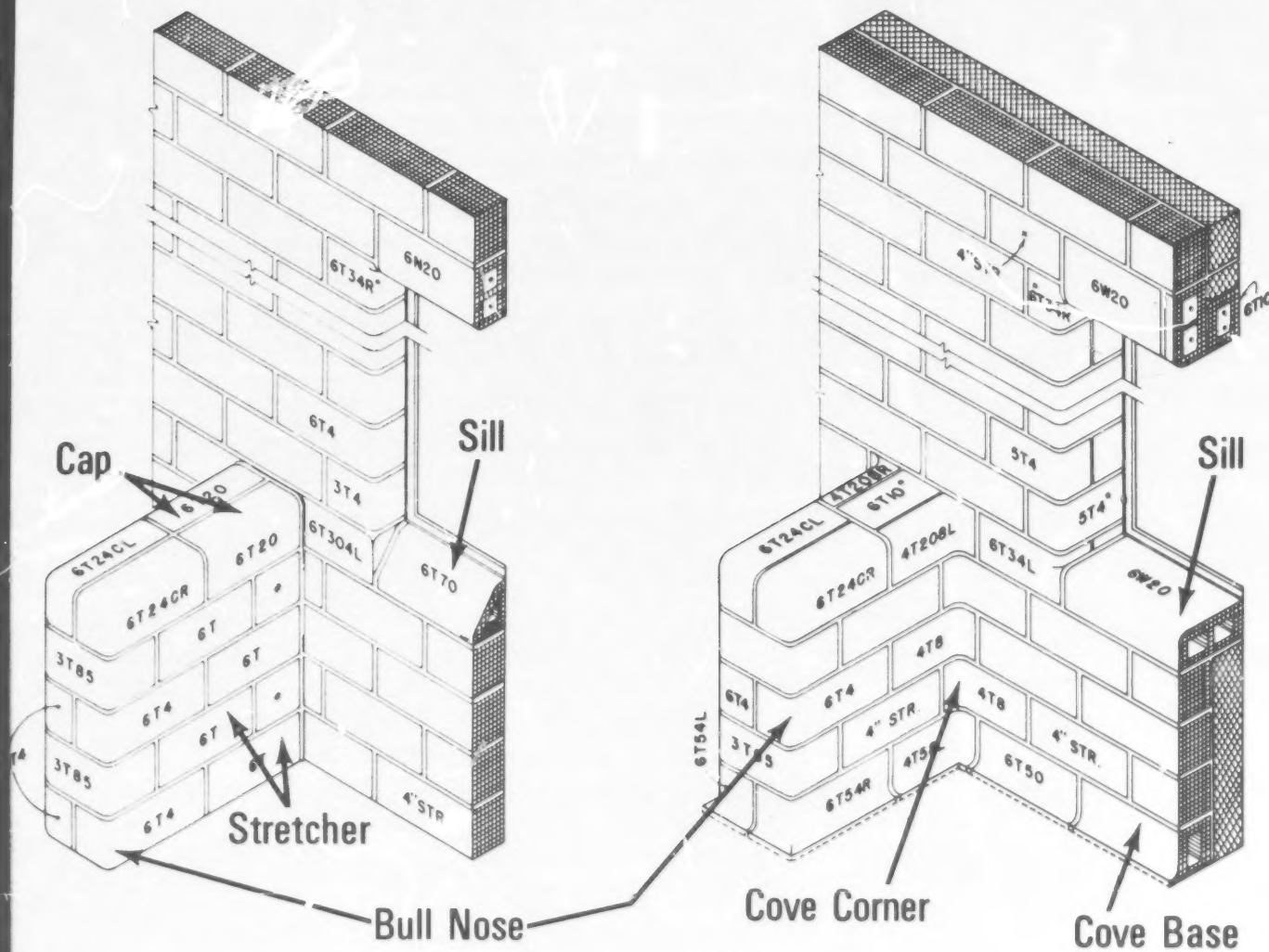


**Running and Stack
Bond Mixed**

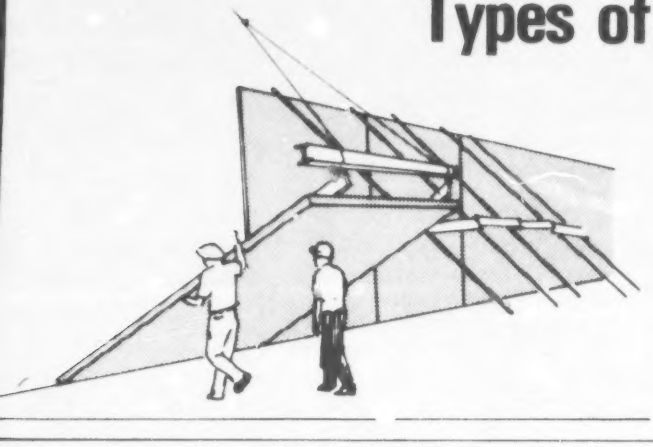


Stack Bond

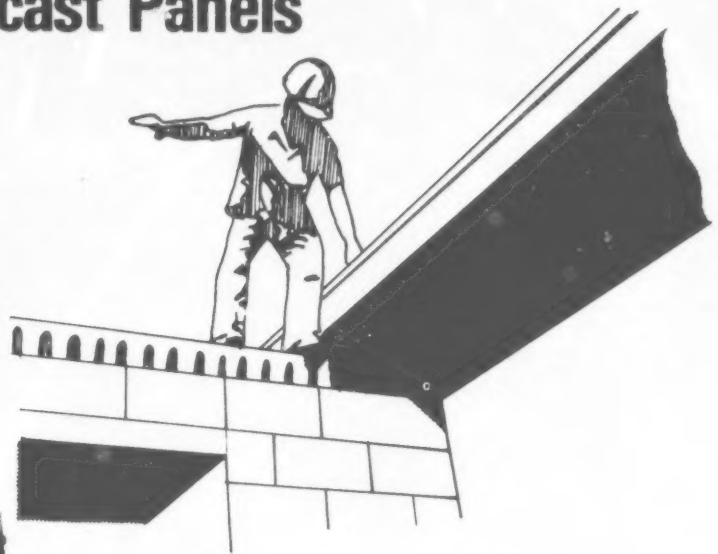
Types of Structural Tile



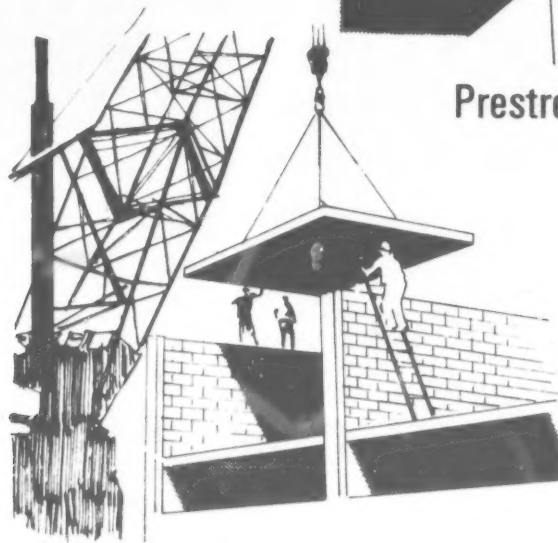
Types of Precast Panels



Concrete Slabs Precast
on Ground at Job Site



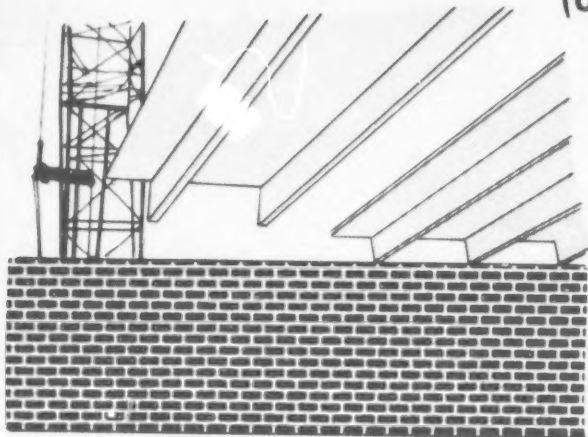
Prestressed Concrete Plank



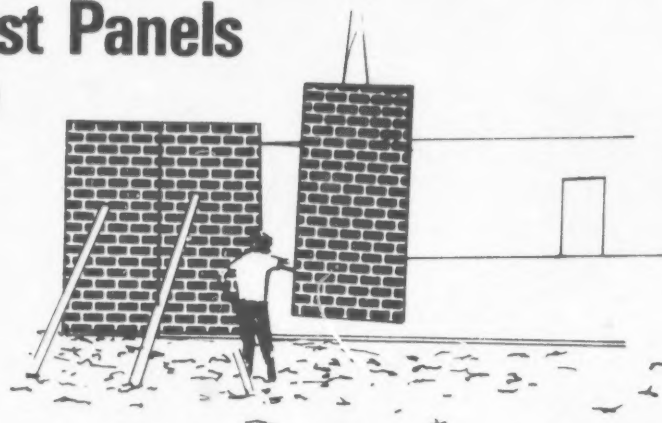
Precast Slabs Made at Off-Site Plant

Types of Precast Panels

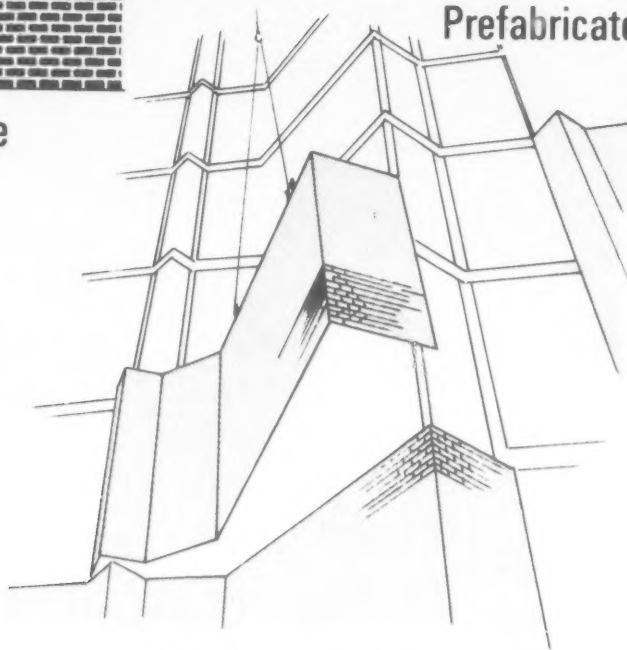
(Continued)



Prestressed Tees Made
at Off-Site Plant

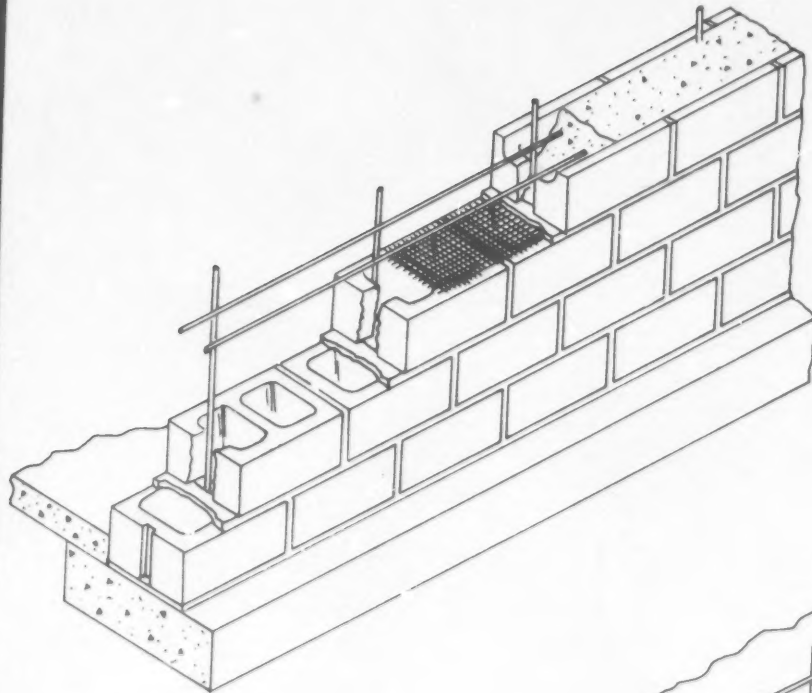


Prefabricated Brick Panel

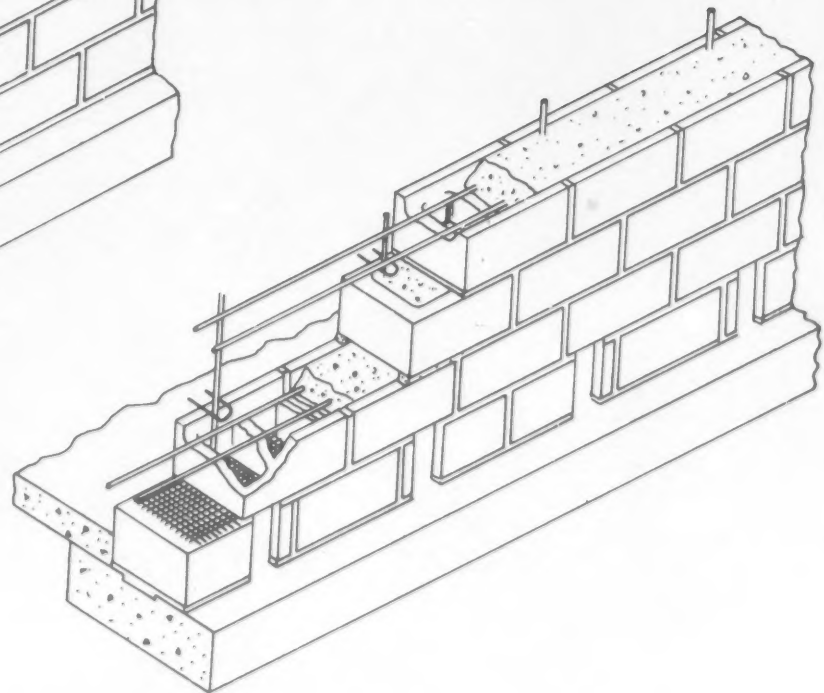


Prefabricated Brick Panel

Grouting

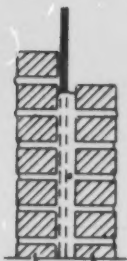


Low Lift

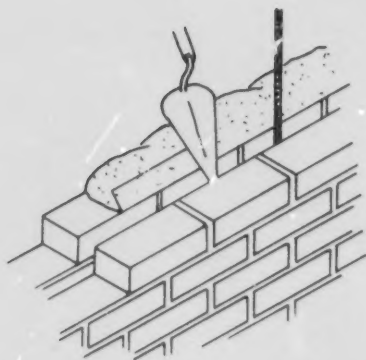


High Lift

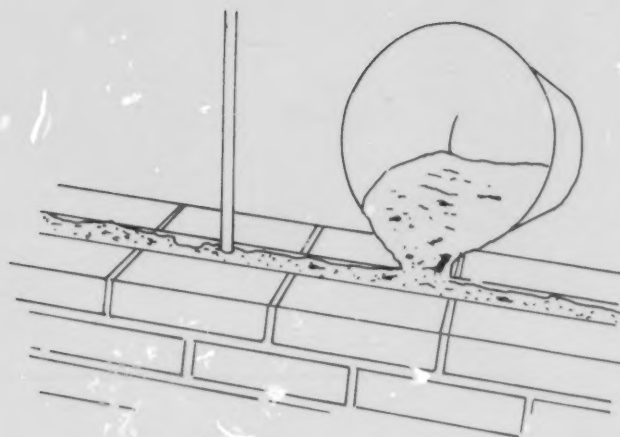
Grouting (Continued)



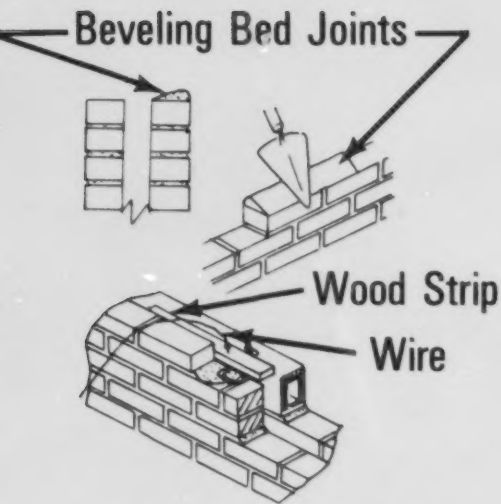
Wall Section



Recommended Method
for Beveling Bed Joint



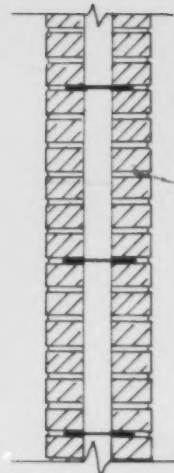
Cavity Walls



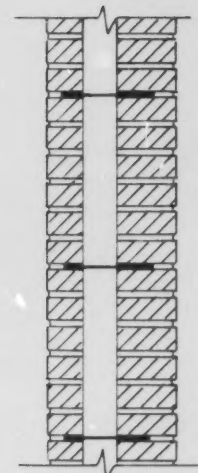
KEEPING THE
CAVITY CLEAN



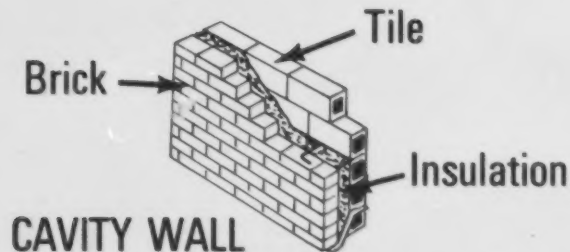
8" BRICK
CAVITY WALL
King Size Brick



10" BRICK
CAVITY WALL
Modular Brick



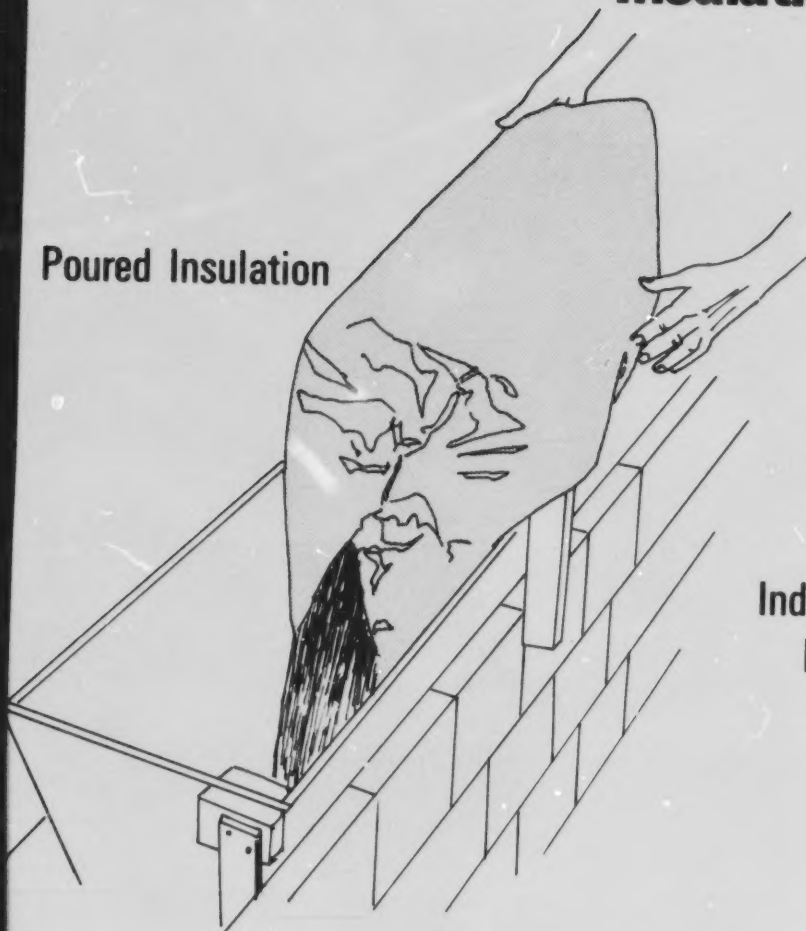
12" BRICK
CAVITY WALL
Norman Brick,
"SCR Brick"



CAVITY WALL

Insulation

Poured Insulation

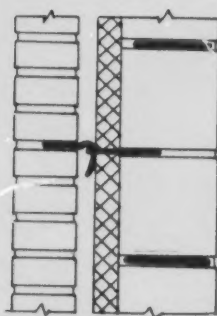
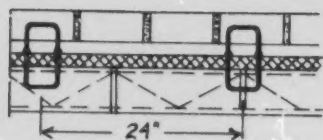


Individual Block
Insulation

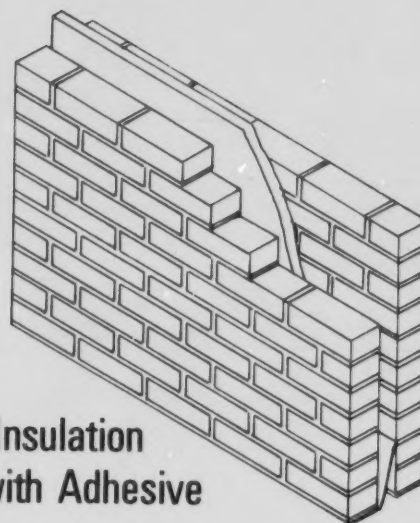


Insulation

(Continued)



Adjustable Wall Ties for Cavity
Walls with Rigid Insulation



Rigid Insulation
with Adhesive

RELATED LAYOUT AND CONSTRUCTION UNIT V

TEST

1. Match the terms on the right to the correct definitions.

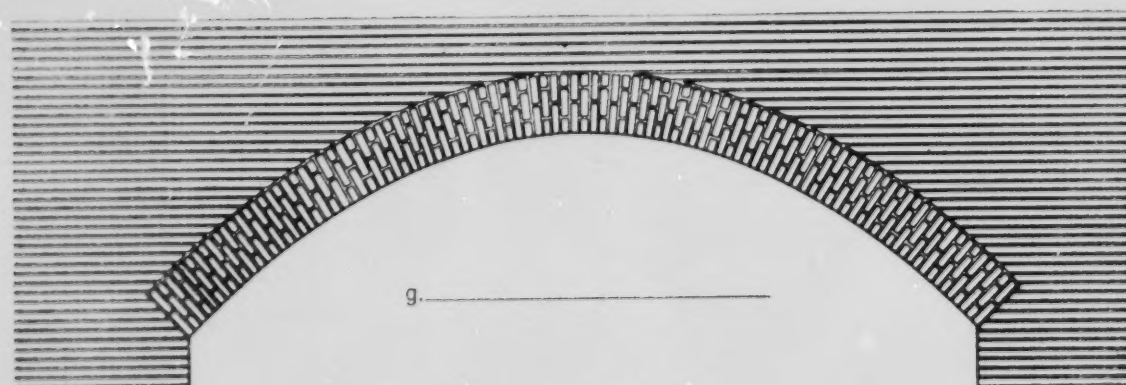
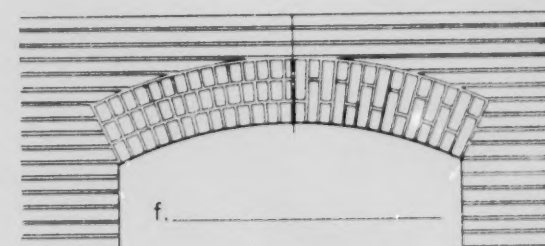
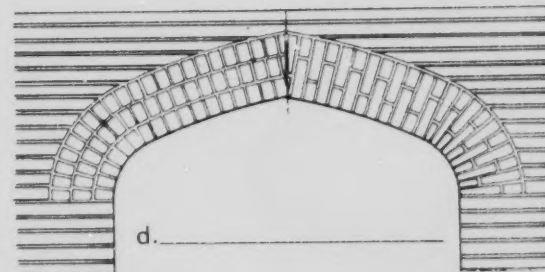
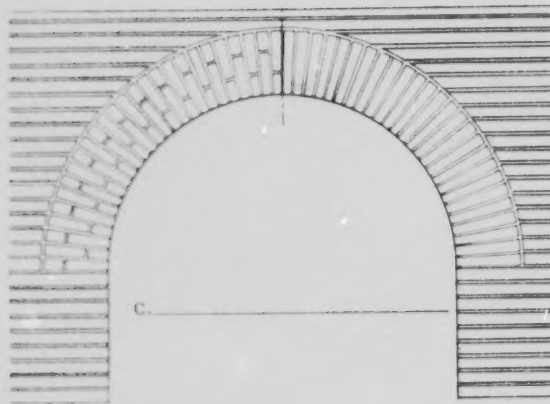
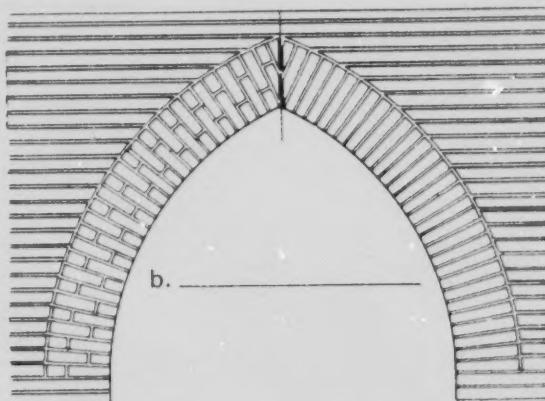
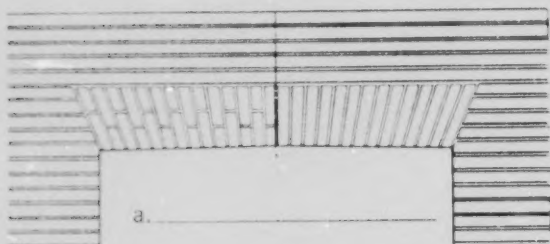
- | | |
|---|---------------------|
| _____ a. Any material used in building construction for the reduction of fire hazard or for protection from heat or cold | 1. Arch |
| _____ b. Any concrete member that is cast in forms at a place other than its final position of use | 2. Precast concrete |
| _____ c. Curved, compressive, structural member spanning openings or recesses; also built flat | 3. Prefab units |
| _____ d. Concrete masonry in which steel reinforcement is embedded so that the two materials act together in resisting forces | 4. Grout |
| _____ e. Mixture of cement material and aggregate to which sufficient water is added to produce a pouring consistency without segregation of the constituents | 5. Insulation |
| _____ f. Masonry construction manufactured in a location other than its final inservice location in the structure | 6. Reinforcement |
| _____ g. Each continuous vertical section of masonry one unit in thickness | 7. Wythe |

2. State two purposes of arches in brick construction.

a.

b.

3. Identify the following types of arches by writing the correct names in the blanks provided.



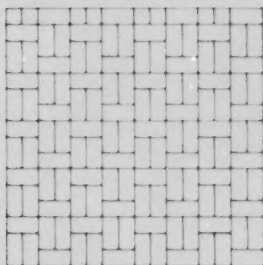
4. List three purposes of masonry paving.

a.

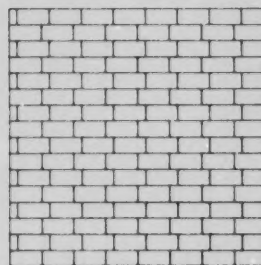
b.

c.

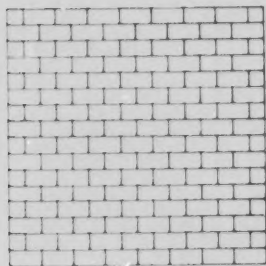
5. Identify the following types of paving patterns by writing the correct names in the blanks provided.



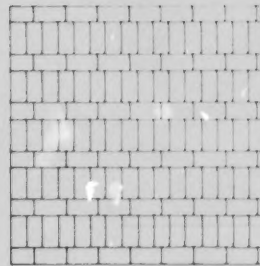
a.



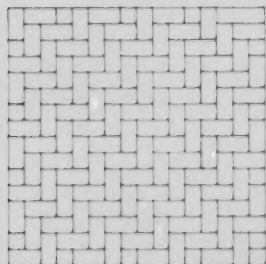
b.



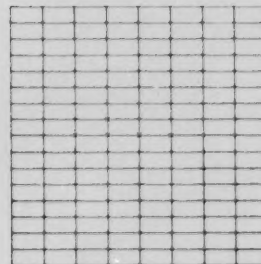
c.



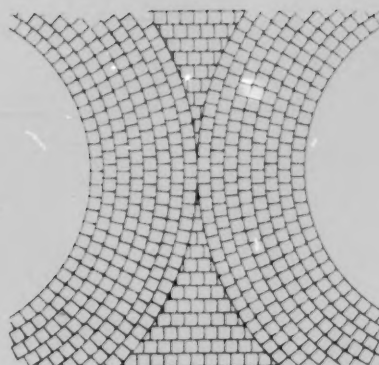
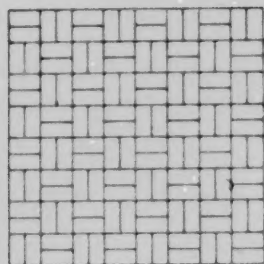
d.



e.



f.



g. _____

h. _____

6. List four purposes of using glazed structural tile.

a. _____

b. _____

c. _____

d. _____

7. Identify the following types of structural tile by writing the correct names in the blanks provided.

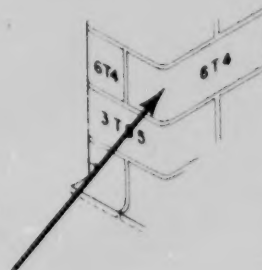
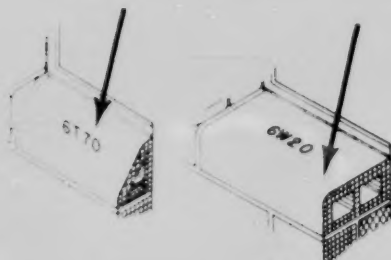


a. _____

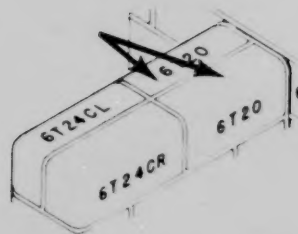
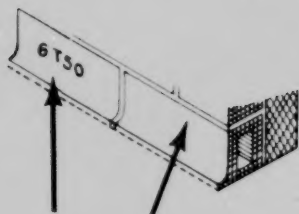


b. _____

c. _____



d. _____



e. _____

f. _____

8. List three purposes of precast panels.
 - a. _____
 - b. _____
 - c. _____
9. Name three types of precast panels.
 - a. _____
 - b. _____
 - c. _____
10. Describe in a short paragraph the procedure for erecting panels or prefab units.

11. Select from the list below purposes of prefab units by placing an "X" in the blanks provided.

- _____ a. More attractive
- _____ b. Constructed before needed
- _____ c. Assembly line construction
- _____ d. Speed and economy
- _____ e. Less scaffolding
- _____ f. Minimum maintenance
- _____ g. Fire resistant
- _____ h. Maximum job efficiency

12. Name three types of prefab units.

- a.
- b.
- c.

13. State three purposes of grouting.

- a.
- b.
- c.

14. Name three types of grouting.

- a.
- b.
- c.

15. List three factors to consider when building cavity walls.

- a.
- b.
- c.

16. Match the sizes of reinforcement bars on the right to the correct numbers of the bars.

_____ a. #3	1. 1/4" diameter
_____ b. #6	2. 3/8" diameter
_____ c. #9	3. 1/2" diameter
_____ d. #2	4. 5/8" diameter
_____ e. #4	5. 3/4" diameter
_____ f. #8	6. 7/8" diameter
_____ g. #5	7. 1" diameter
_____ h. #7	8. 1 1/8" diameter

17. Select from the list below the purposes of insulation by placing an "X" in the blanks provided.

- _____ a. Conserve energy
- _____ b. Reduce cost of heating and cooling
- _____ c. Minimize heat flow through walls, floors, and roofs
- _____ d. Reduce sound transmission
- _____ e. Increase year-round comfort
- _____ f. Beautify
- _____ g. Block light

18. Name four methods of applying insulation.

- a.
- b.
- c.
- d.

RELATED LAYOUT AND CONSTRUCTION
UNIT V

ANSWERS TO TEST

1. a. 5 d. 6 g. 7
 b. 2 e. 4
 c. 1 f. 3
2. a. Used to bridge or span an opening
 b. Used to sustain weight
3. a. Jack
 b. Gothic
 c. Roman or semicircular
 d. Tudor
 e. Multicentered
 f. Segmental
 g. Parabolic
4. Any three of the following:
 a. Adds color
 b. Provides durable wearing surface
 c. Adds to appearance and economy
 d. Can be placed in a bed of mortar and with mortar joints
 e. Can be placed without using mortar
 f. May be used for interior or exterior
 g. May be used for patios, walks, steps, or brick screens
5. a. Basket weave variation
 b. 1/4 running bond
 c. Running bond
 d. Running and stack bond mixed

- e. Herringbone
- f. Stack bond
- g. Basket weave
- h. Circular and running bond mixed
- 6.
 - a. Easily cleaned
 - b. Stain resistant
 - c. Very low maintenance
 - d. Range of light and dark colors
- 7.
 - a. Cove corner
 - b. Stretcher
 - c. Sills
 - d. Bull nose (B.N.)
 - e. Cove base
 - f. Cap
- 8.
 - a. Panels constructed before need arises
 - b. Fast construction
 - c. Maximum job efficiency
- 9. Any three of the following:
 - a. Concrete slabs precast on ground at job site
 - b. Precast slabs made at off-site plant
 - c. Prestressed tees made at off-site plant
 - d. Prestressed concrete plank
 - e. Prefabricated brick panels
- 10. Description should include:
 - a. Work from contract and shop drawings for panel identification
 - b. Check for tolerances of building frame and panel erection
 - c. Check joint size and treatment

- d. Coordinate panels with other trades
- e. Weld, bolt, or anchor panels to structure
- 11. b, c, d, e, f, g, h
- 12. a. Reinforced concrete panels
b. Reinforced brick panels
c. Reinforced masonry unit panels
- 13. a. Used where greater strength is required
b. Acts to resist forces
c. Used to fill cores in hollow block and the empty space between wythes in masonry walls
- 14. a. Mortar
b. Fine grout
c. Coarse grout
- 15. Any three of the following:
 - a. Install flashing at base of wall
 - b. Install weep holes every 24 to 32 inches
 - c. Do not drop mortar in cavity
 - d. Bevel mortar bed joints
 - e. Use proper ties
- 16. a. 2 e. 3
b. 5 f. 7
c. 8 g. 4
d. 1 h. 6
- 17. a, b, c, d, e
- 18. a. Insulation poured into cores and cavities in masonry walls
b. Individual block insulation
c. Rigid insulation applied with adhesive
d. Rigid insulation applied with adjustable wall ties

BASIC GAS CUTTING UNIT VI

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to set up, light, adjust, and turn off an oxyacetylene cutting outfit following the proper order and safety precautions. The student should be able to make ninety-degree cuts in mild steel and cut round stock. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with basic gas cutting to the correct definitions.
2. Identify the parts of an oxyacetylene cutting outfit.
3. Identify the parts of the torch body and cutting attachment.
4. Identify the types of oxyacetylene cutting flames.
5. List reasons for poor cuts.
6. Select from a list causes of a backfire.
7. Describe what happens when a backfire occurs.
8. Describe what happens when a flashback occurs.
9. List in the proper order the steps to follow in case of a flashback.
10. Demonstrate the ability to:
 - a. Set up equipment for oxyacetylene cutting.
 - b. Turn on, light, adjust to a neutral flame, and turn off oxyacetylene cutting equipment.
 - c. Make ninety-degree cuts in mild steel and restart a cut.
 - d. Cut round stock.

BASIC GAS CUTTING UNIT VI

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Secure color flame charts showing types of flames from welding supplier.
- G. Demonstrate and discuss procedures outlined in the job sheets.
- H. Obtain film from your welding supplier to show various techniques in cutting.
- I. Give test.

II. Student:

- A. Read objective sheet.
- B. Study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined in the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet

C. Transparency masters

1. TM 1--Oxyacetylene Cutting Outfit
2. TM 2--Parts of a Torch Body and Cutting Attachment
3. TM 3--Types of Oxyacetylene Cutting Flames

D. Job sheets

1. Job Sheet #1--Set Up Equipment for Oxyacetylene Cutting
2. Job Sheet #2--Turn On, Light, and Adjust the Cutting Torch
3. Job Sheet #3--Make Ninety-Degree Cuts in Mild Steel and Restart a Cut
4. Job Sheet #4--Cut Round Stock

E. Test

F. Answers to test

II. References:

- A. Althouse, Andrew D.; Turnquist, Carl H.; and Bowditch, William A. *Modern Welding*. Homewood, Illinois: The Goodheart-Willcox Co., 1970.
- B. Phipps, Lloyd J.; McColly, H. F.; Scranton, L. L.; and Cook, G. C. *Farm Mechanics Text and Handbook*. Danville, Illinois: Interstate Printers and Publishers, Inc., 1964.
- C. *Smith's Short Course for Gas Cutting, Welding, Brazing*. Minneapolis, Minnesota: Division of Tescom Corp./Education Department of Smith Welding Equipment.
- D. *The Oxyacetylene Handbook: A Manual on Oxyacetylene Welding and Cutting Procedures*. New York: Linde Div./Union Carbide Corp.
- E. Cowan, Earl; Braker, Clifton R.; Penner, Wayman; and Patton, Bob. *Welding*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1974.

BASIC GAS CUTTING
UNIT VI

INFORMATION SHEET

I. Terms and definitions

- A. Flashback--Fire inside of the torch

(CAUTION: This is a very dangerous condition.)

- B. Backfire--Momentary burning back of the flame into the tip

- C. Flame cutting--Process by which iron or steel is heated to a temperature where it can be rapidly oxidized by high purity oxygen flowing under pressure through a cutting torch

(NOTE: As the metal is oxidized, the preheat flame maintains the temperature necessary to keep the oxidation process going in a narrow zone across the length of the base metal.)

- D. Oxide--Terms usually applied to rust, corrosion, coating, film, or scale

(NOTE: Oxygen combines with the metal and causes oxides.)

- E. Oxidizing--Combining oxygen with another substance

Example: * A metal is oxidized when the metal is cut

- F. Slag box--Metal container with a layer of water or sand to catch hot slag

(NOTE: *Slag* is oxidized hot metal.)

- G. Dragline--Situation in which the most distant portion of the cutting stream lags behind the stream nearest the cutting tip

- H. Kerf--Area where the metal was removed in the form of an oxide during the cutting process

- I. Purge--To make clean by removing whatever is foreign

II. Parts of an oxyacetylene cutting outfit (Transparency 1)

- A. Oxygen cylinder

- B. Oxygen regulator

- C. Oxygen pressure regulating screw

INFORMATION SHEET

- D. Oxygen cylinder valve
- E. Acetylene cylinder
- F. Acetylene regulator
- G. Acetylene pressure regulating screw
- H. Acetylene cylinder valve
- I. Safety chain
- J. Cylinder truck
- K. Oxygen hose

(NOTE: Oxygen hoses are usually green.)

- L. Acetylene hose

(NOTE: Acetylene hoses are usually red.)

- M. Oxygen fitting

(NOTE: Oxygen fitting should always have right-hand threads.)

- N. Acetylene fitting

(NOTE: Acetylene fitting should always have a hex-grooved nut and left-hand threads.)

- O. Oxygen torch valve
- P. Torch body
- Q. Acetylene torch valve
- R. Cutting attachment
- S. Oxygen preheat valve
- T. Oxygen cutting lever
- U. Tip
- V. Tip nut

INFORMATION SHEET

III. Parts of the torch body and cutting attachment (Transparency 2)

A. Cutting torch

1. Oxygen fitting
2. Acetylene fitting
3. Oxygen torch valve
4. Acetylene torch valve
5. Torch body
6. Oxygen cutting lever
7. Oxygen preheat valve
8. Tip nut
9. Tip

B. Cutting tip

(NOTE: The selection of the correct tip for the job is determined by the thickness of metal, the size of the tip orifice, and the oxygen cutting pressures. See manufacturer's recommendations.)

1. Preheat orifice

(NOTE: The preheat orifice heats metal to a kindling point of approximately 1600°F.)

2. Cutting orifice

(NOTE: The cutting orifice removes oxidized metal.)

IV. Types of oxyacetylene cutting flames (Transparency 3)

A. Carburizing flame

(NOTE: This is an excess of acetylene.)

B. Neutral flame

(NOTE: A neutral flame burns equal parts of oxygen and acetylene.)

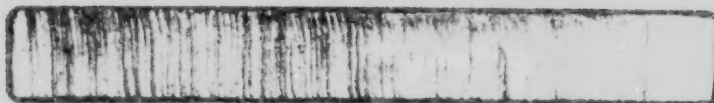
C. Oxidizing flame

(NOTE: This is an excess of oxygen.)

INFORMATION SHEET

V. Reasons for poor cuts

(NOTE: This is a correctly made cut in one-inch plate. The edge is square; the draglines are essentially vertical and are not too pronounced.)



A. Preheat flames too small

(NOTE: Cutting speed was too slow, causing bad gouging at the bottom.)



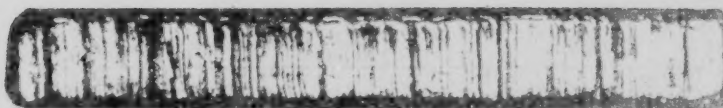
B. Preheat flames too long

(NOTE: The top surface has melted over, the cut edge is irregular, and there is an excessive amount of adhering slag.)



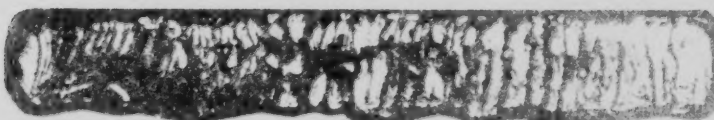
C. Oxygen pressure too low

(NOTE: The top edge has melted over because the cutting speed was too slow.)



D. Oxygen pressure too high; nozzle size too small

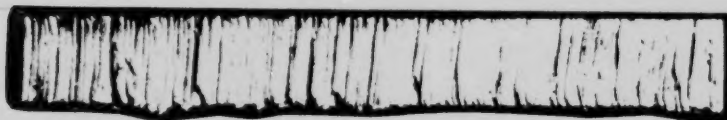
(NOTE: The entire control of the cut has been lost.)



INFORMATION SHEET

- E. Cutting speed too slow

(NOTE: The irregularities of the draglines are emphasized.)



- F. Cutting speed too fast

(NOTE: There is a pronounced break to the dragline and the cut edge is irregular.)



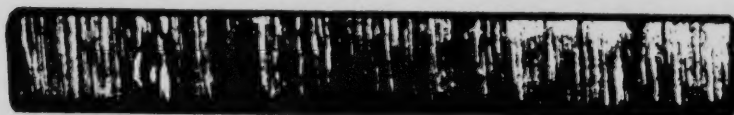
- G. Blowpipe travel unsteady

(NOTE: The cut edge is wavy and irregular.)



- H. Cut lost and not carefully restarted

(NOTE: Bad gouges were caused at the restarting point.)



VI. Causes of a backfire

- A. Insufficient acetylene or oxygen pressure
- B. Loose cutting tip
- C. Dirty tip
- D. Overheating of cutting tip
- E. Bad "O" ring in torch body

(NOTE: The above causes should be carefully checked to control backfire.)

INFORMATION SHEET

VII. Activity during a backfire

- A. Flame burns momentarily back into tip
- B. A loud snap or pop results
- C. Flame either goes out or continues to burn in normal manner

VIII. Activity during a flashback

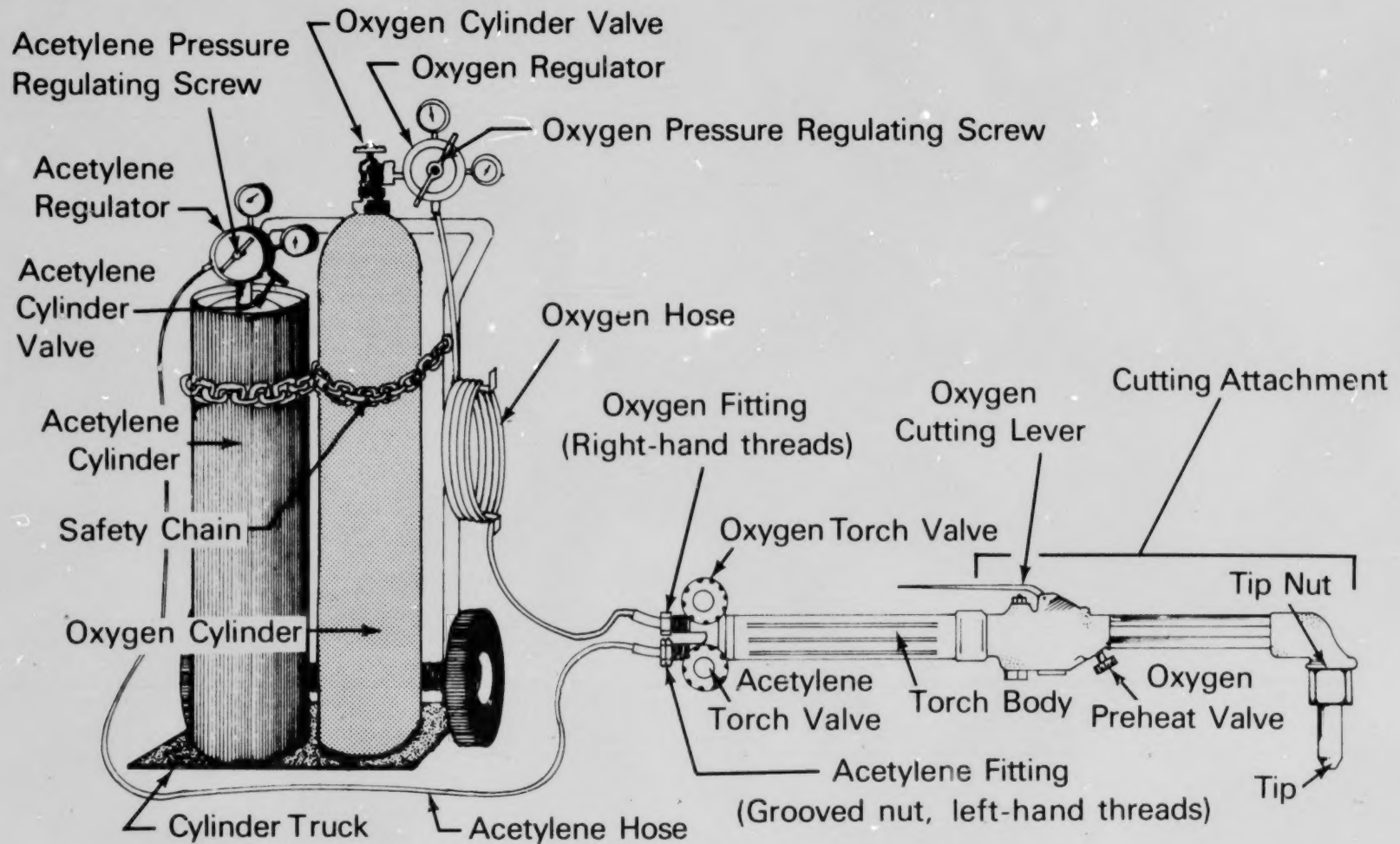
- A. Fire burns inside of torch
- B. Flame disappears inside the torch body
- C. Squealing or hissing noise, sparks, and/or smoke are emitted from the torch tip

IX. Steps to follow in case of a flashback

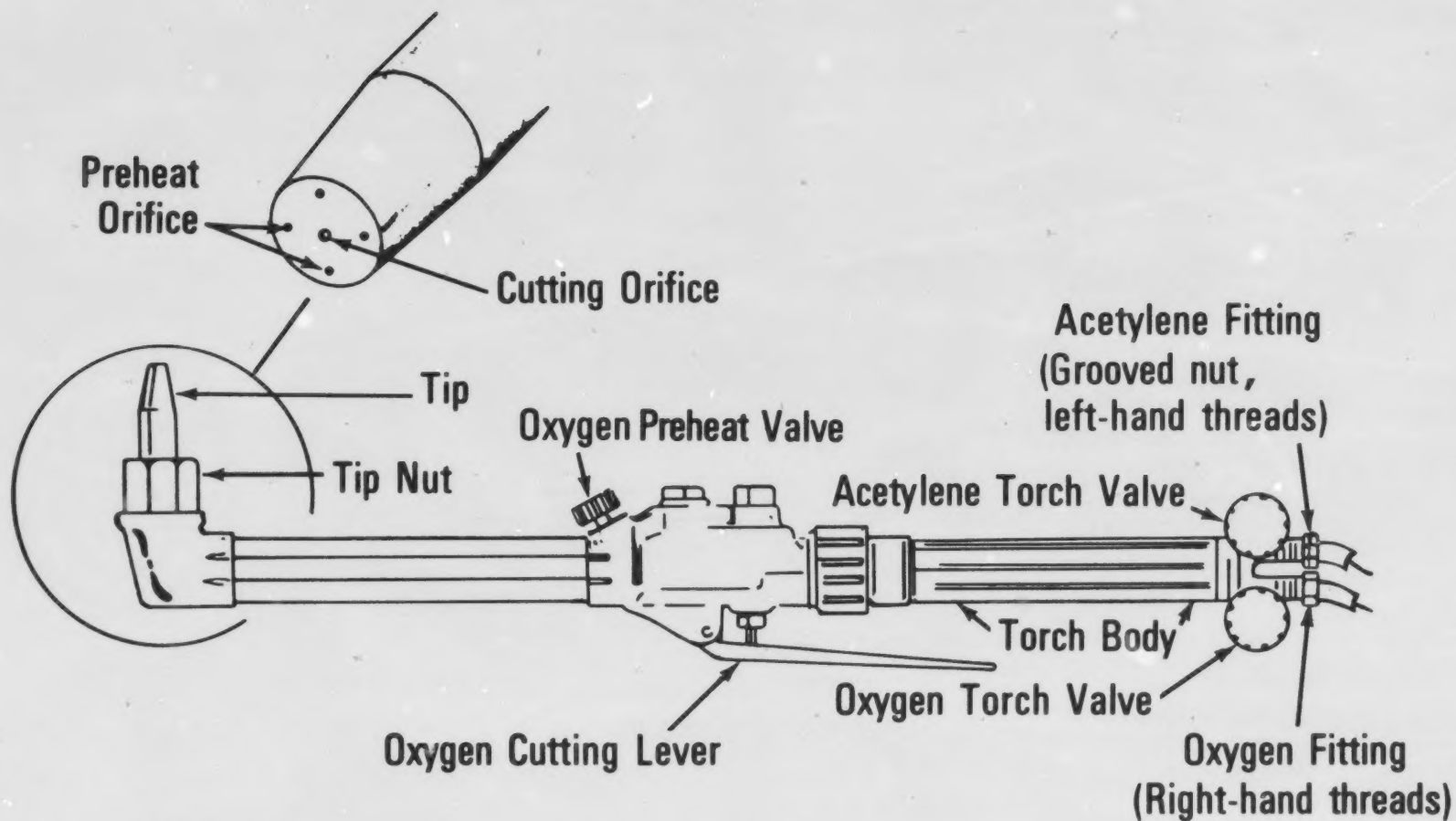
- A. Close oxygen preheat valve
- B. Close oxygen torch valve
- C. Close acetylene torch valve
- D. Release oxygen regulator screw
- E. Release acetylene regulator screw
- F. Examine acetylene unit
- G. Reset regulator pressures
- H. Light torch

(NOTE: If heavy smoke comes out of the torch tip and the torch body becomes hot, the flashback has probably traveled past the mixing chamber into the hose. In this case, shut off the oxygen cylinder valve and the acetylene cylinder valve, then notify the instructor.)

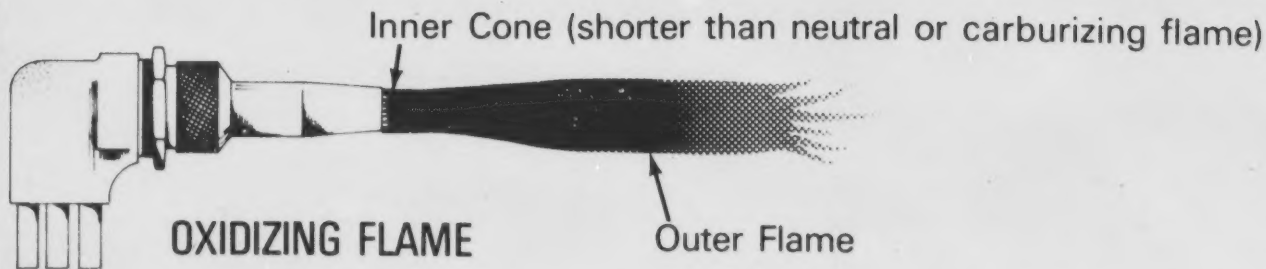
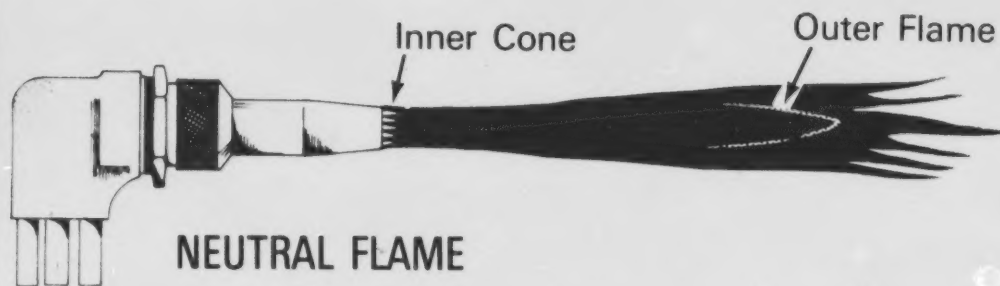
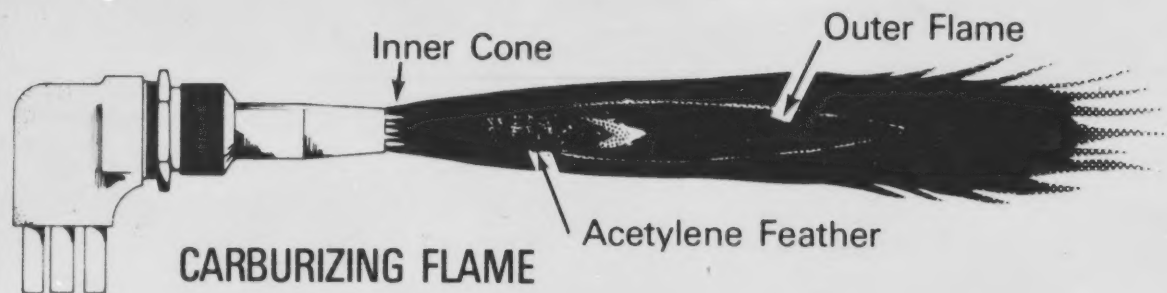
Oxyacetylene Cutting Outfit



Parts of a Torch Body and Cutting Attachment



Types of Oxyacetylene Cutting Flames



BASIC GAS CUTTING
UNIT VI

JOB SHEET #1--SET UP EQUIPMENT FOR OXYACETYLENE CUTTING

I. Tools and materials

- A. Oxygen cylinder
- B. Acetylene cylinder
- C. Oxygen regulator
- D. Acetylene regulator
- E. Hoses
- F. Wrench
- G. Cylinder holder
- H. Water container
- I. Ivory soap
- J. Clean paintbrush
- K. Torch body with tips

II. Procedure

- A. Fasten cylinders in a vertical position
 - B. Remove caps from cylinders
 - C. Crack valves of each cylinder, then close valves
 - D. Connect oxygen regulator to oxygen cylinder
 - 1. Turn adjusting screw on regulator counterclockwise until tension on spring is released
 - 2. Turn cylinder valve wide open slowly
 - E. Connect acetylene regulator to acetylene cylinder
 - 1. Turn adjusting screw on regulator counterclockwise until tension on spring is released
 - 2. Open cylinder valve 1/2 to 3/4 of a turn
- (NOTE: Never open cylinder valve more than 1 1/2 turns.)

JOB SHEET #1

- F. Connect acetylene hose to acetylene regulator; purge hose
- G. Connect oxygen hose to oxygen regulator; purge hose
- H. Connect torch body to oxygen and acetylene hose
- I. Close both valves on torch body
- J. Attach cutting attachment to torch body

(NOTE: The tip size is determined by the thickness of metal to be cut and the manufacturer's recommendations.)

- K. Close oxygen preheat valve on cutting attachment
- L. Turn adjusting screw on oxygen regulator clockwise until working pressure is reached
- M. Turn adjusting screw on acetylene regulator clockwise until correct working pressure is reached
- N. Test all connections for leaks with Ivory soap suds and water

(NOTE: Apply soap suds with a clean paintbrush.)

BASIC GAS CUTTING
UNIT VI

JOB SHEET #2--TURN ON, LIGHT, AND ADJUST THE CUTTING TORCH

- I. Tools and materials
 - A. Oxyacetylene cutting outfit
 - B. Flint lighter
 - C. Wrench
 - D. Gloves
 - E. Safety goggles
 - F. Coveralls or protective clothing
- II. Procedure for turning on, lighting, and adjusting the cutting torch to a neutral flame

(NOTE: Be sure to put on safety equipment such as goggles and gloves before starting procedure.)

 - A. Check all cylinder, regulator, and torch valves to make sure they are closed
 - B. Open acetylene cylinder valve $1/2$ to $3/4$ of a turn

(NOTE: Never open cylinder valve more than $1\ 1/2$ turns.)
 - C. Open acetylene valve on torch one turn
 - D. Turn adjusting screw on acetylene regulator clockwise until desired pressure is reached

(NOTE: Oxygen and acetylene pressures and size of tip depend upon the thickness of metal to be cut. Use pressures and tip size recommended by manufacturer.)
 - E. Close acetylene valve on torch
 - F. Open oxygen cylinder valve all the way
 - G. Open oxygen torch valve all the way
 - H. Open oxygen preheat valve on cutting attachment one turn
 - I. Turn adjusting screw on oxygen regulator clockwise until desired pressure is reached

JOB SHEET #2

- J. Close oxygen preheat valve on cutting attachment
- K. Open acetylene valve on torch 1/4 turn
- L. Light the torch with flint lighter and adjust until smoke on flame clears
- M. Open oxygen preheat valve slowly and adjust to a neutral flame
- N. Depress the oxygen cutting lever and check to see that a neutral flame is present

(NOTE: If necessary, adjust the oxygen preheat valve with the oxygen cutting lever depressed until a neutral flame is secured.)

III. Procedure for turning off the flame and oxyacetylene unit

- A. Close acetylene valve on torch
- B. Close oxygen preheat valve
- C. Close acetylene cylinder valve
- D. Close oxygen cylinder valve
- E. Open acetylene valve on torch

(NOTE: When gauges reach "0", close torch valve and release adjusting screw on acetylene regulator by turning counterclockwise.)

- F. Open oxygen preheat valve on torch

(NOTE: When gauges reach "0", close oxygen preheat valve and release adjusting screw on oxygen regulator by turning counterclockwise.)

- G. Close oxygen valve on torch
- H. Place torch and hose on hanger or brackets provided

BASIC GAS CUTTING
UNIT VI

JOB SHEET #3-MAKE NINETY-DEGREE CUTS IN MILD STEEL
AND RESTART A CUT

I. Tools and materials

- A. Cutting outfit
- B. Mild steel plate 1/4" to 1/2" thick, 4" wide or wider, 8" long or longer
- C. Soapstone with a sharp point or edge
- D. Straightedge
- E. Gloves
- F. Safety goggles
- G. Pliers
- H. Coveralls
- I. Flint lighter
- J. Welding or cutting table
- K. Slag box
- L. Can of water
- M. Cutting tip

II. Procedure for making ninety-degree cuts

(NOTE: Be sure to put on goggles and gloves before starting procedure.)

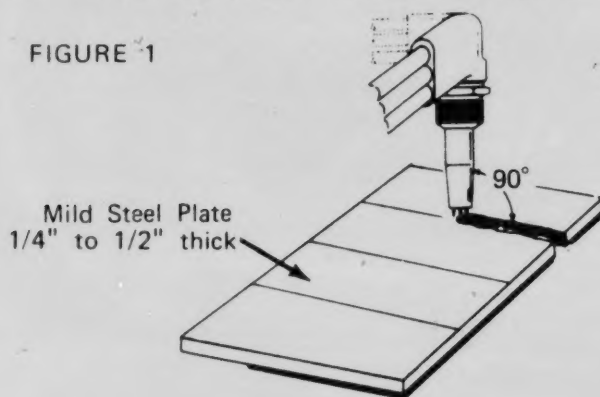
- A. Mark four parallel lines 2" apart on plate to be cut
- B. Adjust oxygen regulator
- C. Adjust acetylene regulator
- D. Place plate to be cut over slag box
- E. Light torch
- F. Adjust to neutral flame

JOB SHEET #3

- G. Assume comfortable position
- H. Place hoses behind you
- I. Maneuver torch with both hands
- J. Hold preheat flame with tip of inner cone $1/16"$ to $1/8"$ above top of plate at right edge until red spot appears
- K. Depress the oxygen cutting lever and move from right to left across the plate (Figure 1)

(NOTE: Left-handed operators should move from left to right.)

FIGURE 1



- L. Hold the tip at right angles to work while cutting with inner cone being $1/16"$ to $1/8"$ above work
 - M. Make 90° cuts until you have developed the proper procedure
 - N. Cool metal by placing in can of water with the aid of pliers
 - O. Show samples to instructor for approval and grading
- III. Procedure for restarting a cut
- A. Release the oxygen cutting lever
 - B. Preheat edge only where cutting action was stopped
 - C. Depress oxygen cutting lever slowly and continue cut

BASIC GAS CUTTING
UNIT VI

JOB SHEET #4--CUT ROUND STOCK

I. Tools and materials

- A. Cutting outfit
- B. Pieces of reinforcing bar, 1/2", 5/8", 3/4", or 1"
- C. Soapstone with sharp point or edge
- D. Tape
- E. Gloves
- F. Safety goggles
- G. Pliers
- H. Coveralls
- I. Flint lighter
- J. Welding or cutting table
- K. Slag box
- L. Can of water
- M. Cutting tip

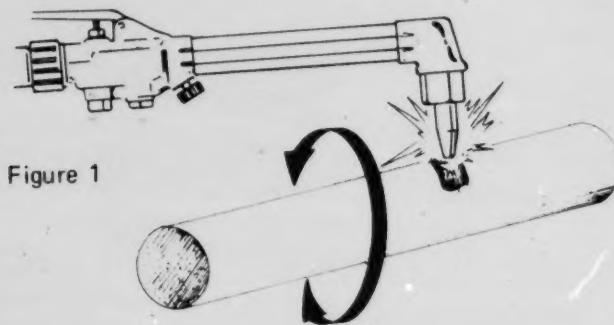
II. Procedure

(NOTE: Be sure to put on goggles and gloves before starting procedure.)

- A. Mark reinforcing bar to desired length
- B. Adjust oxygen and acetylene regulators
- C. Place area to be cut over slag box
- D. Light torch
- E. Adjust to neutral flame
- F. Assume comfortable position
- G. Place hose behind you

JOB SHEET #4

- H. Maneuver torch with both hands
- I. Hold preheat flame with tip of inner cone $1/16''$ to $1/8''$ above edge of reinforcing bar until it becomes red
- J. Depress the cutting lever and rotate torch tip into the direction of travel until rod is cut (Figure 1)



- K. Repeat the procedure for each bar or rod

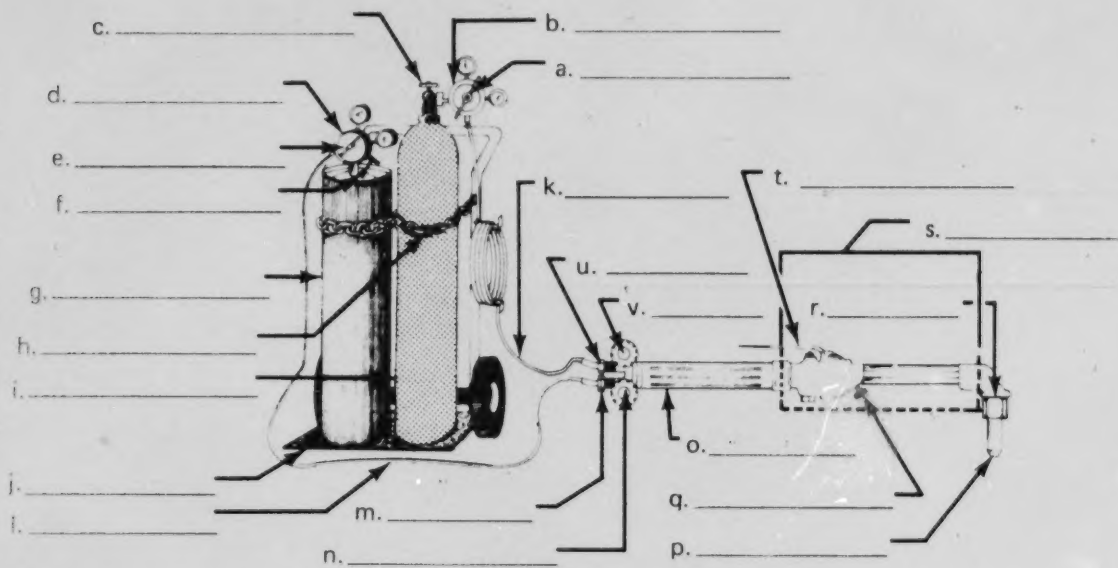
BASIC GAS CUTTING
UNIT VI

TEST

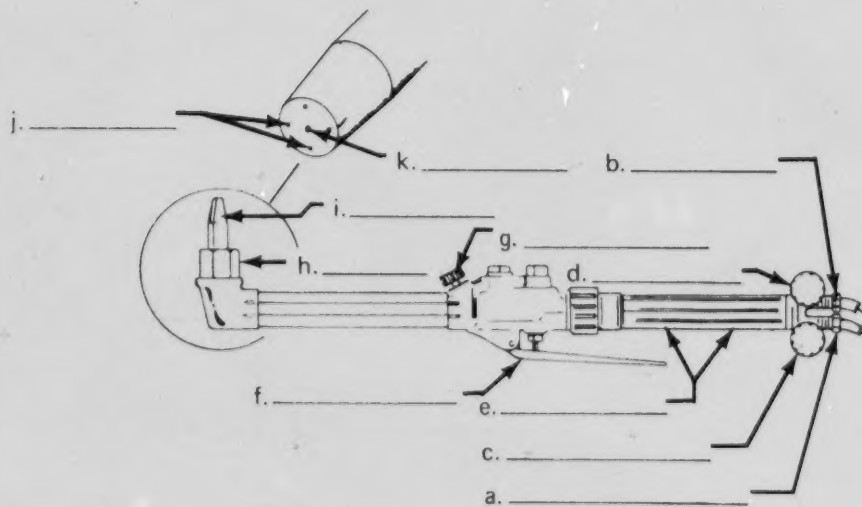
1. Match the terms on the right to the correct definitions.

- | | |
|--|------------------|
| _____ a. Fire inside of the torch | 1. Slag box |
| _____ b. Momentary burning back of the flame into the tip | 2. Oxidizing |
| _____ c. Process by which iron or steel is heated to a temperature where it can be rapidly oxidized by high purity oxygen flowing under pressure through a cutting torch | 3. Flashback |
| _____ d. Metal container with a layer of water or sand to catch hot slag | 4. Dragline |
| _____ e. Situation in which the most distant portion of the cutting stream lags behind the stream nearest the cutting tip | 5. Oxide |
| _____ f. Combining oxygen with another substance | 6. Backfire |
| _____ g. Term usually applied to rust, corrosion, coating, film, or scale | 7. Kerf |
| _____ h. Area where the metal was removed in the form of an oxide during the cutting process | 8. Purge |
| _____ i. To make clean by removing whatever is foreign | 9. Flame cutting |

2. Identify the parts of the oxyacetylene cutting outfit in the diagram below by writing the correct names in the blanks.



3. Identify the parts of the torch body and cutting attachment in the diagram below.



4. Identify the three types of flames in the diagrams below.



a. _____



b. _____



c. _____

5. List five reasons for poor cuts.

a.

b.

c.

d.

e.

6. Select from the list below the causes of a backfire by placing an "X" in the blanks.

_____ a. Too much oxygen

_____ b. Insufficient acetylene or oxygen pressure

_____ c. Too much acetylene

_____ d. Loose cutting tip

_____ e. Overheating of cutting tip

_____ f. Bad "O" ring in torch body

_____ g. Dirty tip

7. Describe what happens when a backfire occurs.

8. Describe what happens when a flashback occurs.

9. List in the proper order the steps to follow in case of a flashback.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.

10. Demonstrate the ability to:
 - a. Set up equipment for oxyacetylene cutting.
 - b. Turn on, light, adjust to a neutral flame, and turn off oxyacetylene cutting equipment.
 - c. Make ninety-degree cuts in mild steel and restart a cut.
 - d. Cut round stock.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

BASIC GAS CUTTING
UNIT VI

ANSWERS TO TEST

- | | | | | | | |
|----|----|---|----|---|----|---|
| 1. | a. | 3 | d. | 1 | g. | 5 |
| | b. | 6 | e. | 4 | h. | 7 |
| | c. | 9 | f. | 2 | i. | 8 |
- 2.
- a. Oxygen pressure regulating screw
 - b. Oxygen regulator
 - c. Oxygen cylinder valve
 - d. Acetylene regulator
 - e. Acetylene pressure regulating screw
 - f. Acetylene cylinder valve
 - g. Acetylene cylinder
 - h. Safety chain
 - i. Oxygen cylinder
 - j. Cylinder truck
 - k. Oxygen hose
 - l. Acetylene hose
 - m. Acetylene fitting
 - n. Acetylene torch valve
 - o. Torch body
 - p. Tip
 - q. Oxygen preheat valve
 - r. Tip nut
 - s. Cutting attachment
 - t. Oxygen cutting lever

- u. Oxygen fitting
- v. Oxygen torch valve
- 3.
 - a. Oxygen fitting
 - b. Acetylene fitting
 - c. Oxygen torch valve
 - d. Acetylene torch valve
 - e. Torch body
 - f. Oxygen cutting lever
 - g. Oxygen preheat valve
 - h. Tip nut
 - i. Tip
 - j. Preheat orifice
 - k. Cutting orifice
- 4.
 - a. Carburizing
 - b. Neutral
 - c. Oxidizing
- 5. Any five of the following:
 - a. Preheat flames too small
 - b. Preheat flames too long
 - c. Oxygen pressure too low
 - d. Oxygen pressure too high; nozzle size too small
 - e. Cutting speed too slow
 - f. Cutting speed too fast
 - g. Blowpipe travel unsteady
 - h. Cut lost and not carefully restarted
- 6. b, d, e, f, g

7. Description should include:
 - a. Flame burns momentarily back into tip
 - b. A loud snap or pop results
 - c. Flame either goes out or continues to burn in normal manner
8. Description should include:
 - a. Fire burns inside of torch
 - b. Flame disappears inside the torch body
 - c. Squealing or hissing noise, sparks, and/or smoke are emitted from the torch tip
9.
 - a. Close oxygen preheat valve
 - b. Close oxygen torch valve
 - c. Close acetylene torch valve
 - d. Release oxygen regulator screw
 - e. Release acetylene regulator screw
 - f. Examine acetylene unit
 - g. Reset regulator pressures
 - h. Light torch
10. Performance skills evaluated to the satisfaction of the instructor

BASIC ARC WELDING UNIT VII

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to name kinds of arc welders, select equipment needed, and list safety precautions observed in arc welding. The student should be able to strike an arc, run a bead, and construct a butt weld. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with arc welding to the correct definitions.
2. List safety precautions used in arc welding.
3. Name kinds of arc welders.
4. Select from a list common equipment used in arc welding.
5. List types of electrodes.
6. Select from a list the common sizes of electrodes used in arc welding.
7. Identify the meanings of the numbers in the electrode classification system.
8. Select from a list purposes of electrode coating.
9. List factors to consider in selecting electrodes.
10. Describe the effects of raising and lowering the arc welding current.
11. Name two methods of striking an arc.
12. Select from a list characteristics of proper arc length.
13. Label the parts of a drawing showing the welding process.
14. Identify kinds of welds.
15. Identify types of weld joints.

16. Name the welding positions.
17. List reasons for poor welds.
18. Demonstrate the ability to:
 - a. Start, stop, and restart a bead.
 - b. Construct a pad weld.
 - c. Construct a butt weld.

BASIC ARC WELDING
UNIT VII

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined on the job sheets.
- G. Give test.

(NOTE: There are several good films and filmstrips available from the various welding supply companies. See your local distributor about films and filmstrips that are available.)

II. Student:

- A. Read objective sheet.
- B. Study information sheet and take additional notes as necessary.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Welding Equipment
 - 2. TM 2--AWS Classification of Electrodes

3. TM 3--Methods of Striking an Arc
4. TM 4--Welding Process
5. TM 5--Kinds of Welds
6. TM 6--Types of Weld Joints
7. TM 7--Welding Positions

D. Job sheets

1. Job Sheet #1--Start, Stop, and Restart a Bead
2. Job Sheet #2--Construct a Pad Weld
3. Job Sheet #3--Construct a Butt Weld

E. Test

F. Answers to test

II. References:

- A. Jones, M. M. *Shopwork on the Farm* 2d ed. New York: McGraw-Hill Book Co., Inc., 1955.
- B. Phipps, Lloyd J.; McColly, H. F.; Scranton, L. L.; and Cook, G. C. *Farm Mechanics Text and Handbook*. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1964.
- C. Kugler, Harold L. *Arc Welding Lessons for School and Farm Shop*. 2d ed. Cleveland, Ohio: James F. Lincoln Arc Welding Foundation, 1957.
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- E. *Hobart Welding School Workbook*. Troy, Ohio: Hobart Brothers' Technical Center.
- F. *New Lessons in Arc Welding*. Cleveland, Ohio: The Lincoln Electric Co./James F. Lincoln Arc Welding Foundation.
- G. Pierre, E. R. *Welding Processes and Power Sources*. Study guide and workbook. Appleton, Wisconsin: Power Publications Co., 1968-69.
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- I. Cowan, Earl; Braker, Clifton; Penner, Wayman; and Patton, Bob. *Welding*. Stillwater: Oklahoma State Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1974.

BASIC ARC WELDING
UNIT VII

INFORMATION SHEET

I. Terms and definitions

- A. Base metal--Metal to be cut or welded (Transparency 4)
- B. Arc--Flow of current across a narrow gap, usually from the tip of the electrode to the base metal (Transparency 4)
- C. Fusion process--Process of heating metal to a molten state and allowing it to cool

(NOTE: The heat is produced by the electric arc in arc welding.)

- D. Arc welding--Process by which two or more pieces of metal are joined together by the fusion process

(NOTE: This is sometimes referred to as *shielded metal arc welding* or *SMAW*.)

- E. Crater--Depression at the termination of a weld (Transparency 4)
- F. Pass--Single longitudinal progression of a welding operation along a joint or weld deposit
- G. Electrode--Metal rod which conducts a current from the electrode holder to the base metal (Transparency 4)

(NOTE: The metal rod melts and deposits the metal in a bead.)

- H. Bead weld--Weld made by one pass of an electrode (Transparency 5)
- I. Bevel--Type of edge preparation
- J. Butt joint--Weld between two metal joints on the same plane (Transparency 6)
- K. Tack weld--Weld made to hold parts in proper alignment until the final welds are made

(NOTE: This type of welding is for assembly purpose only.)

- L. Puddle--That portion of a weld that is molten at the place the heat is supplied (Transparency 4)
- M. AWS--American Welding Society

INFORMATION SHEET

II. Safety precautions in arc welding

- A. Do not look at the arc with the naked eye

(NOTE: The arc will burn the eye more severely than a sunburn and may cause blindness.)

- B. Wear a head or face shield that is in good condition

- C. Wear suitable clothing to protect all parts of the body

Examples: Long-sleeved shirts, leather gloves, turned-down cuffs, high top shoes or boots, and buttoned-down collar

- D. Do not strike an arc or weld until you are sure those in the area have protective equipment or will look the other direction

(NOTE: Yell "COVER" before striking the arc.)

- E. Do not weld near combustible or flammable materials

- F. Do not pick up hot metal

- G. Do not weld in confined places without proper ventilation

- H. Open main switch or disconnect plug when checking a welder

- I. Do not leave electrode holder on welding table or in direct contact with grounded metal

- J. Do not use worn or frayed cables

- K. Stand on dry footing when welding

- L. Keep areas around welder clean

- M. Keep tools and metals in proper location

(NOTE: Others may be added by instructor.)

III. Kinds of arc welders

- A. AC or alternating current

(NOTE: Welder current alternates direction 120 times per second.)

- B. DC or direct current

(NOTE: Welder current flows in the same direction.)

INFORMATION SHEET

C. Motor generator

(NOTE: This generator produces DC current.)

D. Engine generator

(NOTE: This alternating type generator will produce either AC or DC current.)

E. AC/DC transformer-rectifier

(NOTE: This welder, which is supplied by an AC power source, can be switched to produce either AC or DC current.)

IV. Common welding equipment (Transparency 1)

- A. Welding machine
- B. Electrode holder with lead
- C. Ground clamp with lead
- D. Shield or helmet
- E. Gloves
- F. Chipping hammer
- G. Safety goggles or glasses
- H. Wire brush
- I. Electrodes

V. Types of electrodes

- A. Mild steel
- B. High carbon steel
- C. Hard surfacing
- D. Low hydrogen
- E. Alloy

(NOTE: Alloys are used for special purposes.)

INFORMATION SHEET

VI. Common sizes of electrodes

(NOTE: Electrodes range in size from 1/16" to 5/16".)

- A. 3/32"
- B. 1/8"
- C. 5/32"
- D. 3/16"

VII. Meanings of numbers in the electrode classification system (Transparency 2)

- A. E--Stands for electrode used in electric arc welding
- B. First two digits--Indicate tensile strength deposited in thousand pounds per square inch
- C. Third digit--Indicates welding position
 - 1. "1" indicates all positions
 - 2. "2" indicates flat and horizontal only
 - 3. "3" indicates flat only
- D. Fourth or last digit--Represents special characteristics and usability of the electrode

Example:

Last Digit	Last-Digit Characteristics			
	Power Supply	Arc Action	Type of Flux	Penetration Characteristics
0	10, DC +; 20, AC; or DC	Digging	10, organic; 20, mineral	10, deep 20, medium
1	AC or DC+	Digging	Organic	Deep
2	AC or DC	Medium	Ductile	Medium
3	AC or DC	Soft	Ductile	Light
4	AC or DC	Soft	Ductile	Light
5	DC+	Medium	Low hydrogen	Medium
6	AC or DC+	Medium	Low hydrogen	Medium
7	AC or DC	Soft	Mineral	Medium
8	AC or DC+	Medium	Low hydrogen	Medium

(Reprinted by permission from T. B. Jefferson, The Welding Encyclopedia, p. E-4, Monticello Books, Morton Grove, Illinois, 1968.)

INFORMATION SHEET

VIII. Purposes of electrode coating

- A. Stabilize the arc
- B. Shield molten puddle from air
- C. Float impurities out of puddle
- D. Form slag and slow cooling
- E. Increase speed
- F. Improve quality of weld

IX. Factors to consider in selecting electrodes

- A. Base metal strength properties
- B. Base metal composition
- C. Welding position
- D. Welding current
- E. Joint design and fit-up
- F. Thickness and shape of base metal
- G. Production efficiency and job conditions

X. Effects of raising and lowering current

- A. Raising the current produces more heat
- B. Lowering the current produces less heat

XI. Methods of striking an arc (Transparency 3)

- A. Scratching

(NOTE: This method is similar to striking a match.)

- B. Tapping

XII. Characteristics of proper arc length

- A. Distance from the end of the electrode to the base metal is the same as the diameter of the electrode

Example: An arc length of 1/8" is required for a 1/8" electrode

- B. Correct arc length makes a steady hum of the welder and a "frying" sound at the arc

INFORMATION SHEET

XIII. Parts of the welding process (Transparency 4)

- A. Electrode
- B. Wire core
- C. Coating
- D. Arc
- E. Gaseous shield
- F. Weld
- G. Slag
- H. Heat lines
- I. Base metal
- J. Penetration
- K. Crater
- L. 15° - 30° angle of electrode
- M. Direction of travel

XIV. Kinds of welds (Transparency 5)

- A. Fillet
- B. Groove
- C. Bead

XV. Types of weld joints (Transparency 6)

- A. Edge
- B. Butt
- C. Corner
- D. T
- E. Lap

INFORMATION SHEET

XVI. Welding positions (Transparency 7)

- A. Flat
- B. Horizontal
- C. Vertical

(NOTE: Vertical may be either up or down.)

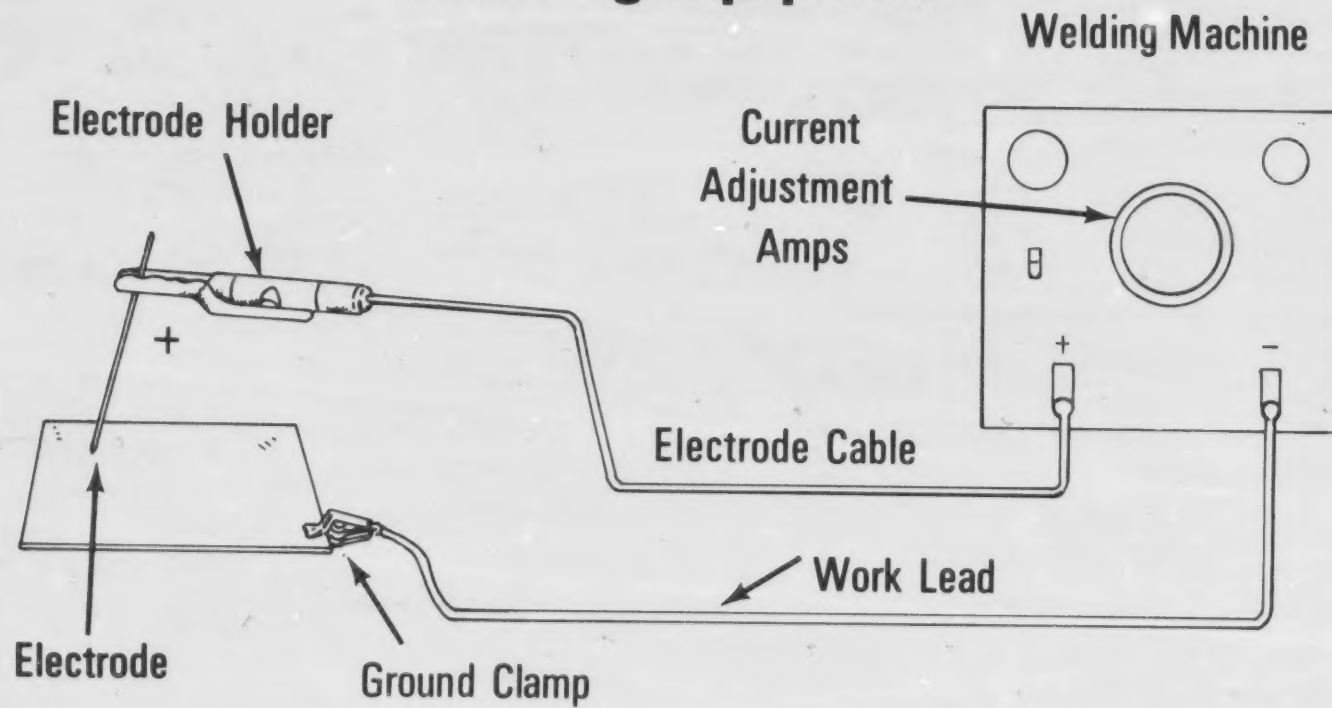
- D. Overhead

XVII. Reasons for poor welds

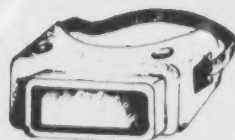
- A. Machine adjustment too hot or too cool
- B. Electrode size too large or too small
- C. Improper movement of electrode
- D. Improper angle of electrode
- E. Improper base metal preparation
- F. Arc length too long or too short

(NOTE: Others may be added by instructor.)

Welding Equipment



Shield or Helmet



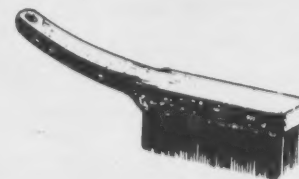
Safety Goggles



Chipping Hammer

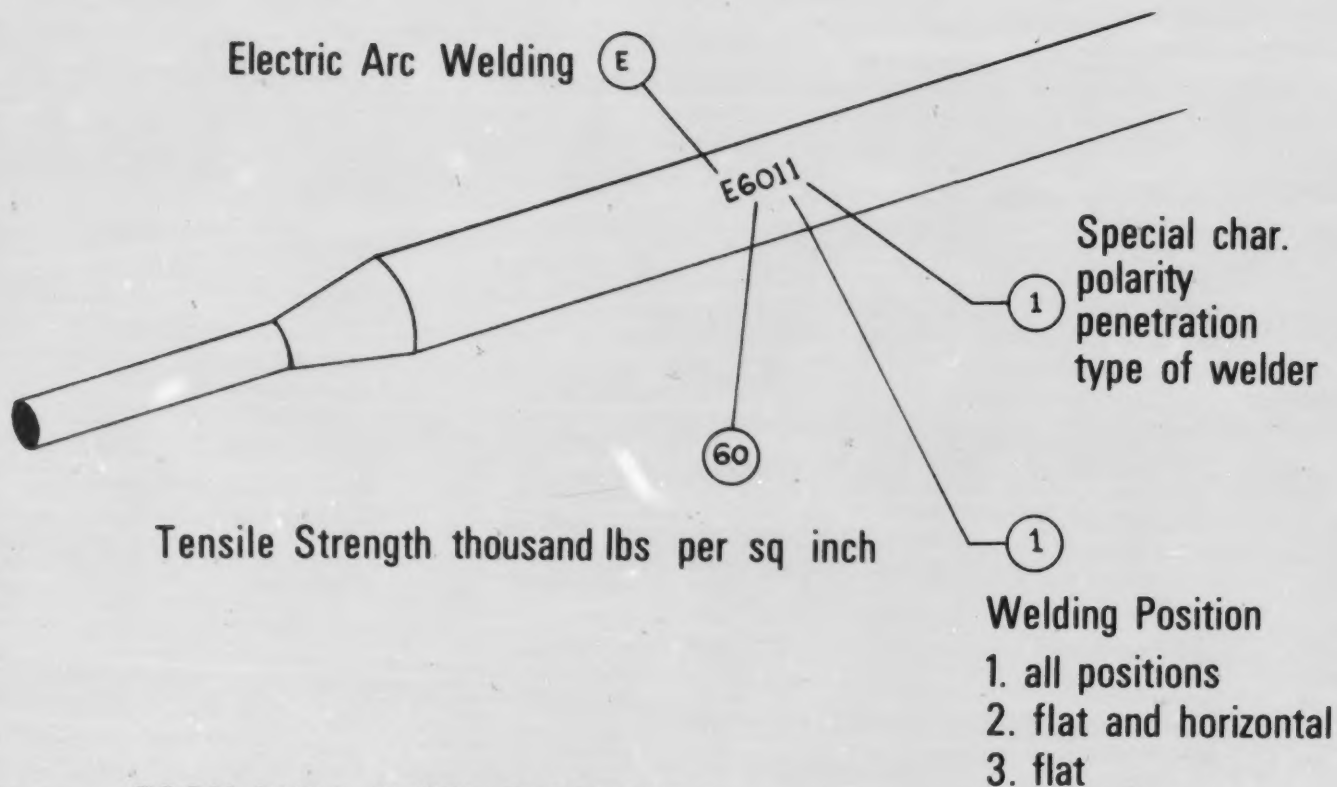


Gloves



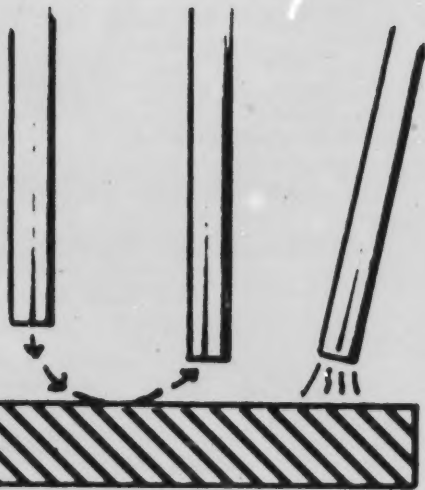
Wire Brush

AWS Classification of Electrodes

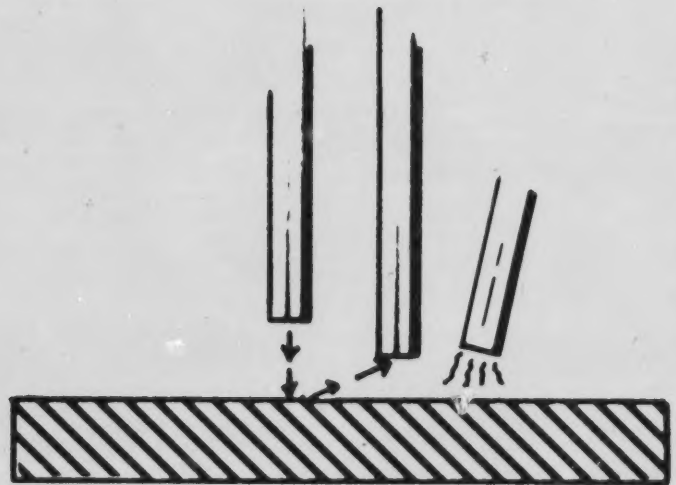


E6011 MILD STEEL ELECTRODE

Methods of Striking an Arc

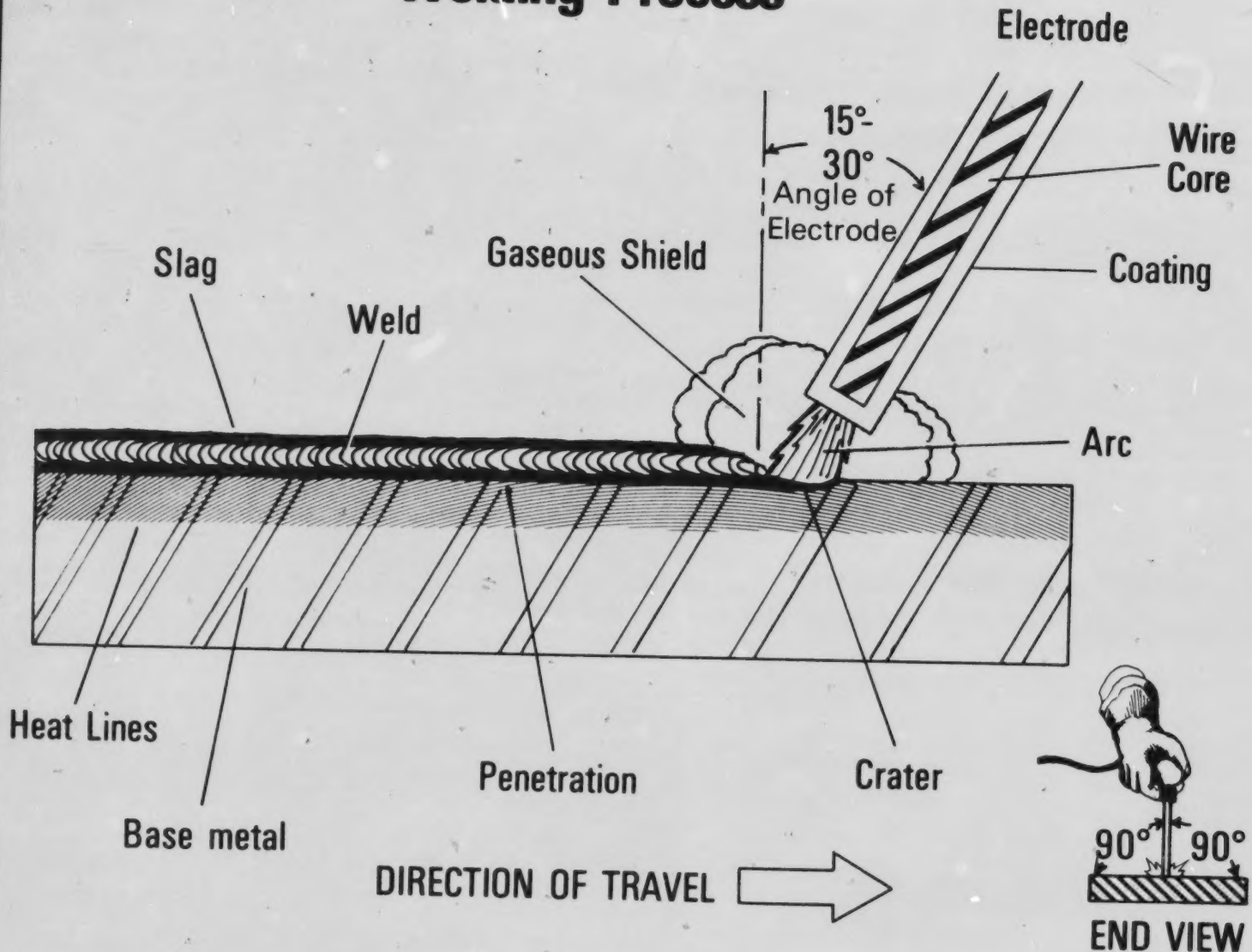


Scratching



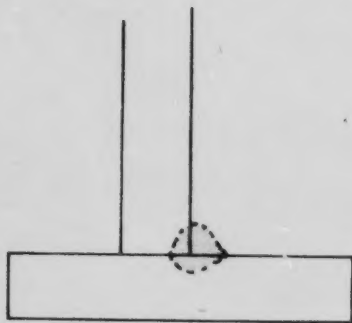
Tapping

Welding Process



Kinds of Welds

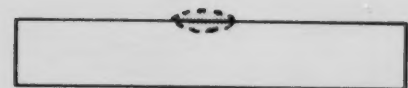
Fillet Weld



Groove Weld

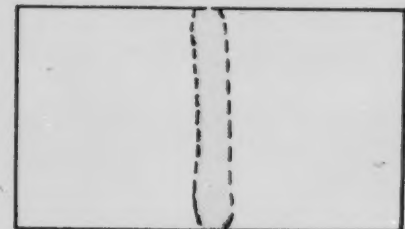
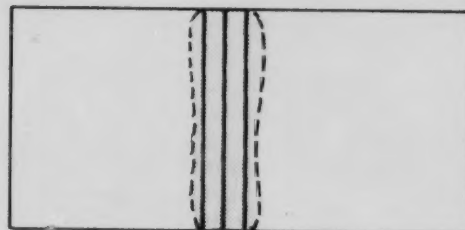
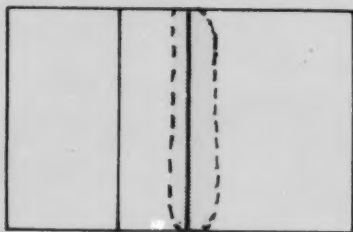


Bead Weld

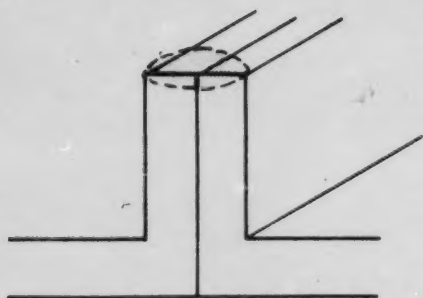


END VIEW

TOP VIEW



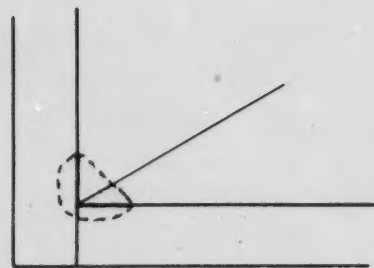
Types of Weld Joints



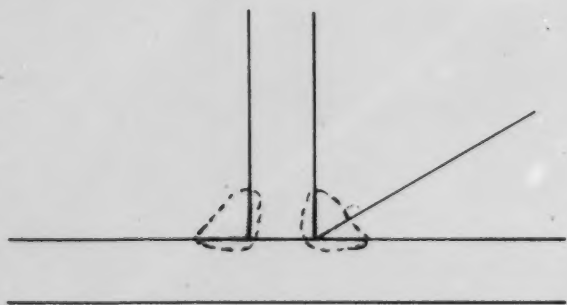
Edge Joint



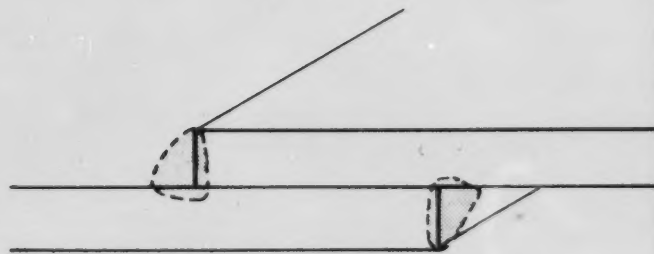
Butt Joint



Corner Joint

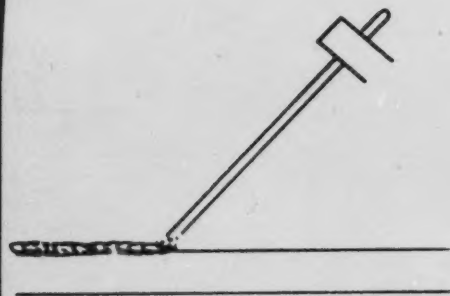


T Joint

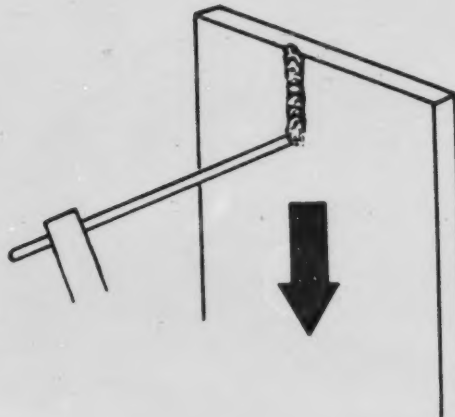


Lap Joint

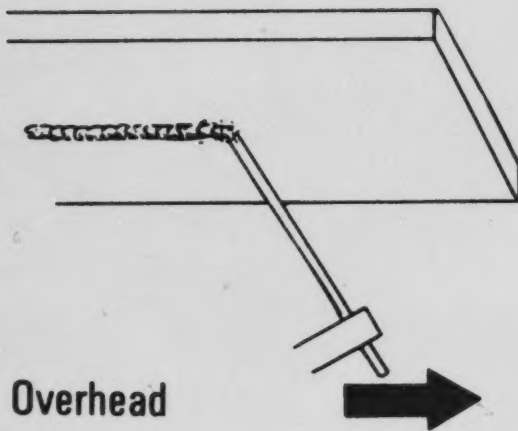
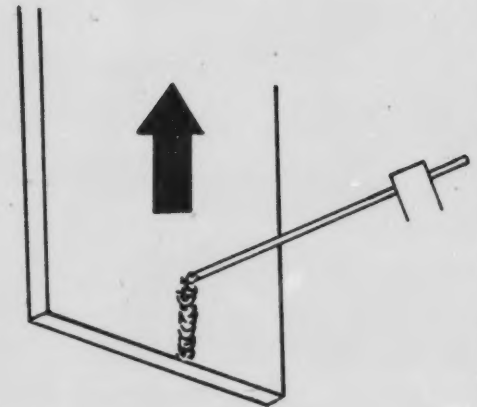
Welding Positions



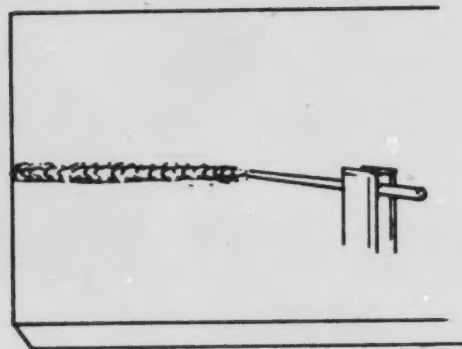
Flat



Vertical



Overhead



Horizontal

BASIC ARC WELDING
UNIT VII

JOB SHEET #1--START, STOP, AND RESTART A BEAD

I. Tools and materials

- A. Piece of metal 1/4" to 3/8" thick, 4" x 4"
- B. Welder
- C. Electrode holder with lead
- D. Ground clamp with lead
- E. Helmet
- F. Gloves
- G. Electrodes
- H. Safety goggles
- I. Chipping hammer
- J. Wire brush

II. Procedure

(NOTE: Be sure to put on safety equipment such as goggles and gloves before starting procedure.)

- A. Prepare metal for welding
- B. Strike arc 1" from edge where bead is to begin (Figures 1 and 2)

FIGURE 1

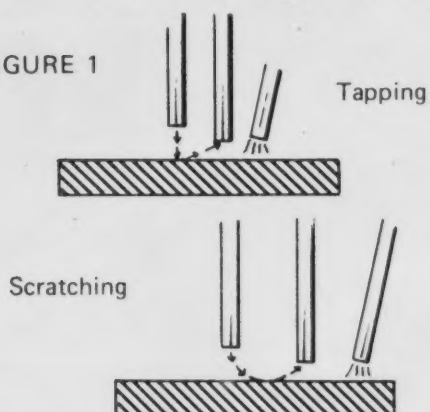
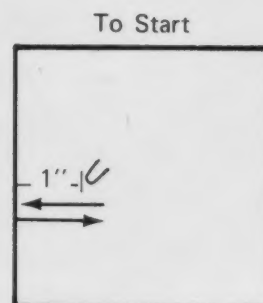


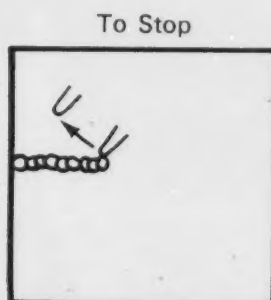
FIGURE 2



JOB SHEET #1

- C. Move to edge when arc burns brightly, maintaining the correct arc length; begin forming the puddle
- D. Move across metal two inches
- E. Move electrode back through the puddle and lift up to stop bead (Figure 3)

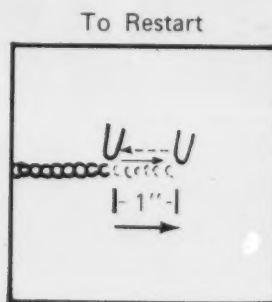
FIGURE 3



(NOTE: This will prevent cracks from forming in the puddle.)

- F. Strike arc about 1" in front of crater to restart (Figure 4)

FIGURE 4



- G. Move back through the crater when arc burns brightly and then resume the bead

(NOTE: This is necessary in order for beads to blend with one another without a change in continuity.)

BASIC ARC WELDING
UNIT VII

JOB SHEET #2--CONSTRUCT A PAD WELD

I. Tools and materials

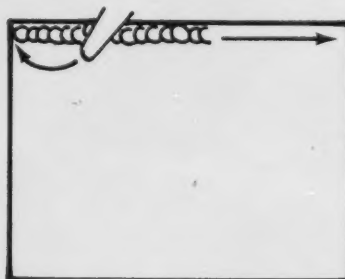
- A. Piece of metal $1/4"$ to $3/8"$ thick, $4" \times 4"$
- B. Welder
- C. Electrode holder and lead
- D. Ground clamp and lead
- E. Helmet
- F. Gloves
- G. Electrodes
- H. Safety goggles
- I. Chipping hammer
- J. Wire brush

II. Procedure

(NOTE: Be sure to put on safety equipment before starting procedure.)

- A. Prepare metal for welding
- B. Strike arc and move to point to begin pad (Figure 1)

FIGURE 1



- C. Lay a straight bead across the plate using a weaving motion

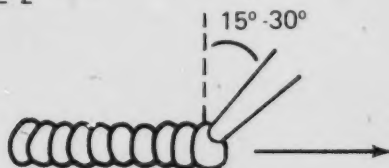
(NOTE: In using an E6011 electrode, it is necessary to use some type of rod manipulation in running a bead.)

JOB SHEET #2

- D. Hold electrode at a 15° to 30° angle in direction of travel and lower electrode as rod burns away to maintain correct arc length (Figure 2)

(NOTE: There should be 90° on each side of the electrode.)

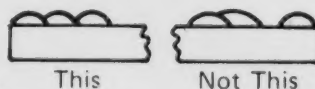
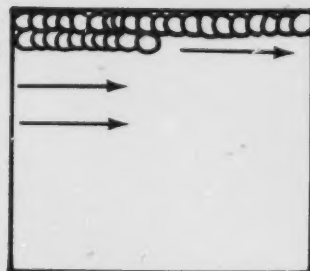
FIGURE 2



- E. Move electrode steadily from right to left across pad
 F. Clean the slag from each bead before starting the next one
 G. Run beads until pad is full, overlapping each bead (Figure 3)

FIGURE 3

Overlap about
1/3 of bead



- H. Let each bead cool until slag is black before chipping
 I. Run additional layers until desired thickness is obtained

BASIC ARC WELDING
UNIT VII

JOB SHEET #3--CONSTRUCT A BUTT WELD

I. Tools and materials

- A. Pieces of metal $1/4''$ to $3/8''$ thick, $3'' \times 6''$ (2)
- B. Welder
- C. Electrode holder with lead
- D. Ground clamp with lead
- E. Helmet
- F. Gloves
- G. Electrode
- H. Safety goggles
- I. Chipping hammer
- J. Wire brush

II. Procedure

(NOTE: Be sure to put on safety equipment before starting procedure.)

- A. Prepare metal to be welded (Figure 1)

(NOTE: If metal thickness is over $1/8''$, the edges should be beveled.)

FIGURE 1

 $1/16''$ to $3/32''$

Bevel edges

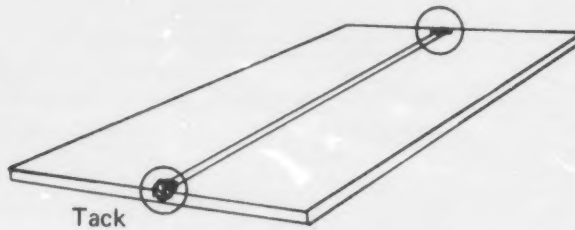
JOB SHEET #3

- B. Place two pieces of metal parallel to each other

(NOTE: Leave a space from 1/16" to 3/32" between them.)

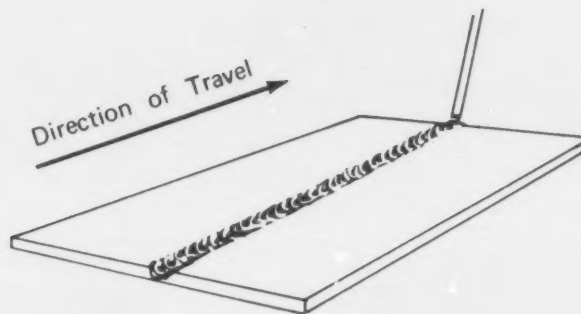
- C. Tack weld pieces together at both ends (Figure 2)

FIGURE 2



- D. Complete weld using a single pass (Figure 3)

FIGURE 3



- E. Chip slag and brush weld

BASIC ARC WELDING
UNIT VII

TEST

1. Match the terms on the right to the correct definitions.

- | | |
|---|-------------------|
| _____ a. Metal to be cut or welded | 1. Arc welding |
| _____ b. Weld made by one pass of an electrode | 2. Fusion process |
| _____ c. Metal rod which conducts a current from the electrode holder to the base metal | 3. Arc |
| _____ d. Process by which two or more pieces of metal are joined together by the fusion process | 4. Base metal |
| _____ e. Depression at the termination of a weld | 5. Crater |
| _____ f. Type of edge preparation | 6. Pass |
| _____ g. That portion of a weld that is molten at the place the heat is supplied | 7. Bead weld |
| _____ h. Process of heating metal to a molten state and allowing it to cool | 8. Bevel |
| _____ i. Single longitudinal progression of a welding operation along a joint or weld deposit | 9. Butt joint |
| _____ j. Weld between two metal joints on the same plane | 10. Tack weld |
| _____ k. American Welding Society | 11. Electrode |
| _____ l. Flow of current across a narrow gap, usually from the tip of the electrode to the base metal | 12. Puddle |
| _____ m. Weld made to hold parts in proper alignment until the final welds are made | 13. AWS |

2. List five safety precautions used in arc welding.
 - a.
 - b.
 - c.
 - d.
 - e.
3. Name two kinds of arc welders.
 - a.
 - b.
4. Select from the list below common equipment used in arc welding by placing an "X" in the blanks.
 - _____ a. Welding machine
 - _____ b. Electrodes
 - _____ c. Gloves
 - _____ d. Wire brush
 - _____ e. Cart
 - _____ f. Shield or helmet
 - _____ g. Chipping hammer
 - _____ h. Ball-peen hammer
 - _____ i. Safety goggles or glasses
 - _____ j. Hacksaw
 - _____ k. Screwdriver
5. List three types of electrodes.
 - a.
 - b.
 - c.

6. Select from the list below the common sizes of electrodes used in arc welding by placing an "X" in the blanks.

_____ a. 1/16"

_____ f. 3/16"

_____ b. 1/8"

_____ g. 3/8"

_____ c. 3/32"

_____ h. 3/64"

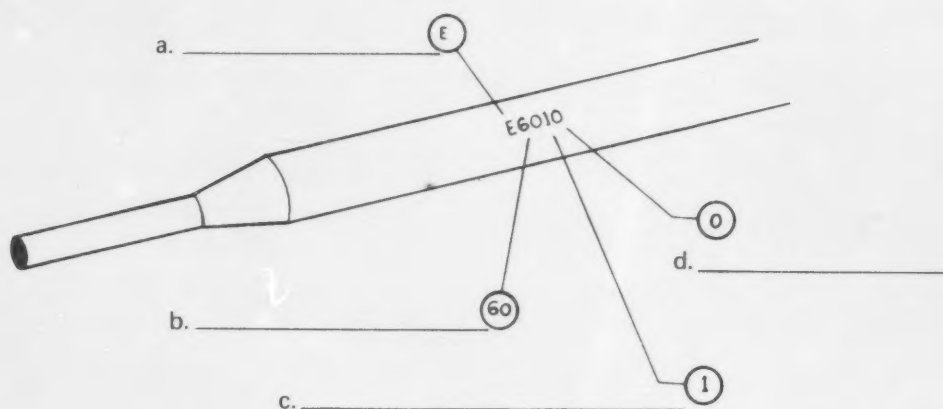
_____ d. 5/16"

_____ i. 3/4"

_____ e. 5/32"

_____ j. 1/2"

7. Identify the meanings of the numbers in the electrode classification system.



8. Select from the list below purposes of electrode coating by placing an "X" in the blanks.

_____ a. Increase speed

_____ b. Stabilize the arc

_____ c. Protect the welder from shock

_____ d. Shield molten puddle from air

_____ e. Keep electrode from shorting out

_____ f. Form slag and slow cooling

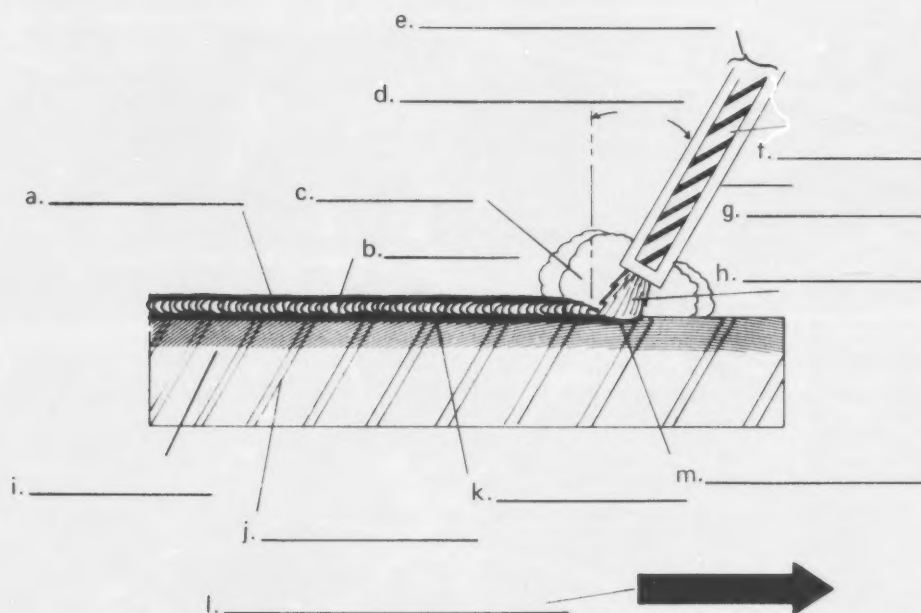
_____ g. Tack metal to be welded

_____ h. Float impurities out of puddle

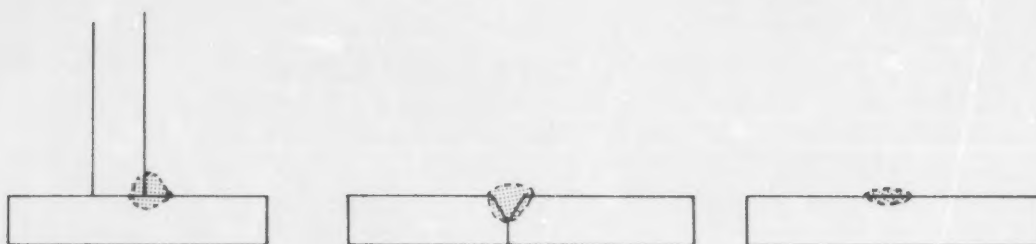
_____ i. Improve quality of weld

9. List four factors to consider in selecting electrodes.
 - a.
 - b.
 - c.
 - d.
10. Describe the effects of raising and lowering the arc welding current.
11. Name two methods of striking an arc.
 - a.
 - b.
12. Select from the list below characteristics of proper arc length by placing an "X" in the blanks.
 - ☐ a. Arc length is always 1/2" long
 - ☐ b. Arc length is the same as the length of the electrode
 - ☐ c. Distance from the end of the electrode to the base metal is the same as the diameter of the electrode
 - ☐ d. Correct arc length makes a steady hum of the welder and a "frying" sound at the arc

13. Label the parts of the welding process illustrated below by writing the correct names in the blanks.



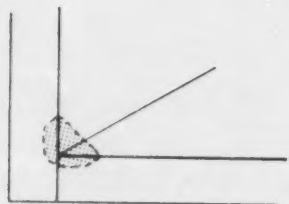
14. Identify the following welds.



15. Identify the following five types of weld joints.



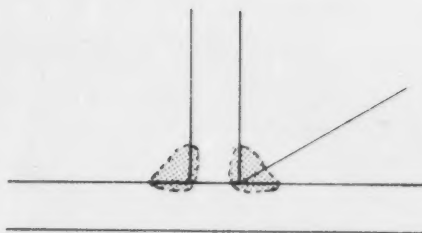
a. _____



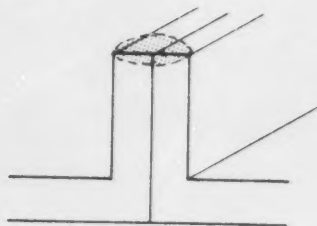
b. _____



d. _____



c. _____



e. _____

16. Name the four welding positions.

a.

b.

c.

d.

17. List four reasons for poor welds.

a.

b.

c.

d.

18. Demonstrate the ability to:
- a. Start, stop, and restart a bead.
 - b. Construct a pad weld.
 - c. Construct a butt weld.

(NOTE: If these have not been accomplished prior to the test, ask the instructor when the above activities should be completed.)

BASIC ARC WELDING
UNIT VII

ANSWERS TO TEST

1.

a. 4	h. 2
b. 7	i. 6
c. 11	j. 9
d. 1	k. 13
e. 5	l. 3
f. 8	m. 10
g. 12	
2. Any five of the following:
 - a. Do not look at the arc with the naked eye
 - b. Wear a head or face shield that is in good condition
 - c. Wear suitable clothing to protect all parts of the body
 - d. Do not strike an arc or weld until you are sure those in the area have protective equipment or will look the other direction
 - e. Do not weld near combustible or flammable materials
 - f. Do not pick up hot metal
 - g. Do not weld in confined places without proper ventilation
 - h. Open main switch or disconnect plug when checking a welder
 - i. Do not leave electrode holder on welding table or in direct contact with grounded metal
 - j. Do not use worn or frayed cables
 - k. Stand on dry footing when welding
 - l. Keep areas around welder clean
 - m. Keep tools and metals in proper location
 - n. Others as added by the instructor

3. Any two of the following:
 - a. AC or alternating current
 - b. DC or direct current
 - c. Motor generator
 - d. Engine generator
 - e. AC/DC transformer-rectifier
4. a, b, c, d, f, g, i
5. Any three of the following:
 - a. Mild steel
 - b. High carbon steel
 - c. Hard surfacing
 - d. Low hydrogen
 - e. Alloy
6. b, c, e, f
7.
 - a. E-Electrode used in electric arc welding
 - b. 60-Tensile strength deposited in thousand pounds per square inch
 - c. 1-Welding position; all positions
 - d. 0-Special characteristics and usability of electrode
8. a, b, d, f, h, i
9. Any four of the following:
 - a. Base metal strength properties
 - b. Base metal composition
 - c. Welding position
 - d. Welding current
 - e. Joint design and fit-up
 - f. Thickness and shape of base metal
 - g. Production efficiency and job conditions

10. Description should include:
 - a. Raising the current produces more heat
 - b. Lowering the current produces less heat
11.
 - a. Scratching
 - b. Tapping
12. c, d
13.
 - a. Slag
 - b. Weld
 - c. Gaseous shield
 - d. 15° - 30° angle of electrode
 - e. Electrode
 - f. Wire core
 - g. Coating
 - h. Arc
 - i. Heat lines
 - j. Base metal
 - k. Penetration
 - l. Direction of travel
 - m. Crater
14.
 - a. Fillet
 - b. Groove
 - c. Bead
15.
 - a. Butt
 - b. Corner
 - c. T
 - d. Lap
 - e. Edge

16.
 - a. Flat
 - b. Horizontal
 - c. Vertical
 - d. Overhead
17. Any four of the following:
 - a. Machine adjustment too hot or too cool
 - b. Electrode size too large or too small
 - c. Improper movement of electrode
 - d. Improper angle of electrode
 - e. Improper base metal preparation
 - f. Arc length too long or too short
 - g. Others as added by instructor
18. Performance skills evaluated to the satisfaction of the instructor

717

718

BRICKLAYING PROGRESS CHART

Section G-1 Shop Practices

Student's Name

Job

Unit I
Spreading Mortar and Laying Brick to a Line

Unit II
Wall Layout
and Construction

Unit III
Chimneys
and Fireplaces

1

2

3

4

5

6

7

8

9

10

1

2

3

1

2

3

Unit Test

Spread Mortar on a 2x4 Using the
Western MethodSpread Mortar on a 2x4 Using the
Eastern MethodSpread Mortar on a 2x4 Using the
Western MethodBuild 90° Brick Leads Using the
Eastern MethodBuild 90° Brick Leads Using the
Western MethodLay Brick to a Line with Established
Leads Using the Western MethodLay Brick to a Line with Established
Leads Using the Eastern Method

Build 90° Block Leads

Lay 8" Block to a Line with Established
Leads

Unit Test

Lay Out and Construct a Section of Wall
with a Joint ReinforcementLay Out and Construct a Section of Wall
with Openings and Joint Reinforcement

Unit Test

Construct a Firebox

Construct a Fireplace

1

2

3

4

5

6

7

8

[illegible]750

752

BRICKLAYING PROGRESS CHART

Section G-2 Shop Practices

Student's Name _____

Job

Unit Test

Unit IV
Cut StoneUnit V
Related
Layout and
ConstructionUnit VI
Basic Gas
CuttingUnit VII
Basic Arc
Welding

1

1

1

2

:

4

1

1

1

•

152/c

Set Up Equipment Cutting

Equipment for On,
Torch

Make Ninety Steel and Add

Cut Round	Restart a C	Half-Degree Cut	Adjust the Cut

Stock

Unit Test

Start, Stop

Construct

Construct a Pad Weld

a Butt Weld

1

2

3

4

5

6

7

8

[illegible]

Accuracy

85% Correct

85% Correct

85% Correct
Total

To correct

To neutral flame
 Squared

Constructor
Square
flame

with no more than 2 restarts
± 1/8" in correct length

85% Correct
M:

Correct

To satisfy

Proper bead width and penetration

CLEANING, POINTING, AND CAULKING UNIT I

TERMINAL OBJECTIVE

After completion of this unit, the student should be able to list the purposes of cleaning, pointing, caulking, and waterproofing. The student should be able to describe the procedures for cleaning and caulking and identify tools used for repairing brick or block walls. The student should be able to demonstrate the ability to repair a brick or block wall and caulk a window and/or door frame and a control joint. This knowledge will be evidenced through demonstration and by scoring eighty-five percent on the unit test.

SPECIFIC OBJECTIVES

After completion of this unit, the student should be able to:

1. Match terms associated with cleaning, pointing, and caulking to their correct definitions.
2. List purposes of cleaning.
3. Identify cleaning equipment.
4. Name types of cleaning materials used on masonry units.
5. Describe the cleaning procedure.
6. List safety precautions to follow when cleaning.
7. State the purpose of pointing.
8. Identify tools used for repairing brick or block walls.
9. Describe the procedure for pointing.
10. Explain the difference between pointing mortar and brick mortar.
11. Select from a list the purposes of caulking.
12. Match types of caulking to specific uses.
13. Identify tools used in caulking.
14. State the purpose of waterproofing.

15. Match types of waterproofing to their specific uses.
16. Name safety precautions to follow when waterproofing.
17. Demonstrate the ability to:
 - a. Repair a brick or block wall.
 - b. Caulk a door and/or window frame and a control joint.

CLEANING, POINTING, AND CAULKING UNIT I

SUGGESTED ACTIVITIES

I. Instructor:

- A. Provide student with objective sheet.
- B. Provide student with information and job sheets.
(NOTE: Instructors should provide real situations for students to see concerning cleaning, pointing, and caulking.)
- C. Make transparencies.
- D. Discuss terminal and specific objectives.
- E. Discuss information sheet.
- F. Demonstrate and discuss procedures outlined on the job sheets.
- G. Give test.

II. Student:

- A. Read objective sheet.
- B. Read and study information sheet.
- C. Demonstrate the ability to accomplish the procedures outlined on the job sheets.
- D. Take test.

INSTRUCTIONAL MATERIALS

I. Included in this unit:

- A. Objective sheet
- B. Information sheet
- C. Transparency masters
 - 1. TM 1--Cleaning Equipment
 - 2. TM 2--Tools for Repairing Brick or Block Walls

3. TM 3--Caulking Procedure
4. TM 4--Tools Used in Caulking

D. Job sheets

1. Job Sheet #1--Repair a Brick or Block Wall
2. Job Sheet #2--Caulk a Door and/or Window Frame and a Control Joint

E. Test

F. Answers to test

II. References:

- A. *Specification Data: 1-Part Acrylic Terpolymer Sealant*. Cleveland, Ohio: Tremco Manufacturing Co., April 1971.
- B. Dalzell, J. Ralph. *Simplified Masonry Planning and Building*. New York: McGraw-Hill Book Co., Inc., 1955.
- C. Dalzell, J. Ralph, and Townsend, Gilbert. *Masonry Simplified*. Vol. 1. Chicago: American Technical Society, 1956.
- D. Roark, William F., and Plummer, Harry C. *Bricklaying Vocational Training*. Student textbook. McLean, Virginia: Brick Institute of America, 1973.

CLEANING, POINTING, AND CAULKING UNIT I

INFORMATION SHEET

I. Terms and definitions

- A. Cleaning--Process of removing mortar stains or burrs from a finished wall section
- B. Pointing--Jointing or troweling mortar into a joint after masonry units are laid
- C. Tuckpointing--Filling cut-out or defective mortar joints in masonry with fresh mortar
- D. Efflorescence--Powder or stain found on the surface of masonry, resulting from deposition of water-soluble salts
- E. Muriatic acid--Mild solution of hydrochloric acid used for cleaning
- F. Grout--Cementitious component of high water-cement ratio, permitting it to be poured into spaces within masonry walls

(NOTE: Grout consists of portland cement, lime, and aggregate formed by adding water to mortar.)

II. Purposes of cleaning

- A. Removal of mortar, mortar stain, and other materials, such as dirt, deposited on masonry during construction
- B. Removal of efflorescence
- C. Removal of other stains that appear on new and old structures

III. Cleaning equipment (Transparency 1)

- A. Rubber pail
- B. Long-handled acid brush
- C. Rubber gloves
- D. Safety goggles
- E. Scraper
- F. Water hose with nozzle

INFORMATION SHEET

IV. Types of cleaning materials used on masonry units

A. Hydrochloric acid (muriatic)

(NOTE: This method can be used for cleaning most types of masonry and should be done with extreme caution.)

B. Manufactured cleaner other than acid

(NOTE: This method is used for cleaning most types of masonry units. Check with supplier for correct manufactured cleaner number to use on various types of brick. Such things to consider are color, texture, glazed brick, and tile.)

V. Cleaning procedure

A. Dry-clean walls

B. Protect windows, doors, and trim

C. Remove large particles of mortar with wood paddles and scrapers before wetting the wall

(NOTE: On some masonry walls, a fine carborundum stone may be used. Check specifications.)

D. Use sandblasting in some areas

E. Flush off all loose mortar and dirt

F. Soak the area to be cleaned with plenty of water just before applying acid

G. Apply acid

1. Fill a nonmetallic container about 3/4 full with clean water and add acid so mixture will be nine parts water to one part acid

(NOTE: Put acid into water, not water into acid.)

2. Place a small block of wood in container holding mixed material as a reminder that acid has been added

3. Apply acid mix using a long-handled fiber brush

4. Scrub as you apply

(NOTE: Scrub COMPLETELY to remove all foreign material.)

INFORMATION SHEET

5. Apply acid to an area that can be scrubbed and rinsed before it will dry

(NOTE: This area will depend on weather conditions.)

6. Remove mortar stain that may have been missed when dry-cleaning by using a piece of brick, wood paddle, or scraper
7. Rinse area washed with acid with plenty of water
8. Keep metal, limestone, and cast stone well flushed with clean water
9. Make sure water runs to the bottom of the wall when rinsing

(NOTE: If rinse water runs to bottom of the wall and off, you can be sure that the acid and dirt have been removed.)

VI. Safety precautions to follow when cleaning

- A. Use a plastic or hard rubber container for mixing acid

(NOTE: A metallic container will react with the acid.)

- B. Use a long-handled brush to apply acid
- C. Wear protective clothing
- D. Check staging planks for traps
- E. Make sure no one is working below you
- F. Do not throw objects off staging
- G. Make sure guard rails are secure
- H. Use swing scaffold only after proper instruction

(NOTE: Follow OSHA regulations on use of the swing scaffold.)

VII. Purpose of pointing--To make joints weatherproof

VIII. Tools for repairing brick or block walls (Transparency 2)

- A. Plug or mash hammer
- B. Tuckpointer's grinder
- C. Round jointer

INFORMATION SHEET

- D. Flat jointer
 - E. Tuckpointer's plugging chisel
 - F. Tuckpointer's hawk
 - G. Soft brush
- IX. Procedure for pointing
- A. Remove mortar joints to a depth of at least 1/2"
 - B. Remove dirt and dust from joints
 - C. Wet joints thoroughly before pointing
 - D. Mix pointing mortar about one hour before time to be used
 - E. Remix pointing mortar, keeping it stiffer than regular brick mortar
 - F. Tuckpoint mortar into open joints so that joints are filled solid
- X. Pointing mortar vs brick mortar
- A. Pointing mortar--Portland cement, very fine sand, and lime mixed to a stiff consistency
 - B. Brick mortar--Portland cement, coarse sand, and lime mixed to a consistency that can be handled with a trowel
- XI. Purposes of caulking (Transparency 3)
- A. Prevent water penetration around window and door frames and brick and block panels
 - B. Seal expansion joints and control joints
 - C. Fill joints for precast concrete and panel-to-panel joints
- XII. Types of caulking and their uses
- A. Acrylic terpolymer sealant--Used for all vertical and horizontal joints
 - B. Polyurethane sealant--Used in narrow and wide joints in floors, decks, and sidewalks
 - C. Oil-based caulking--Used for vertical and horizontal joints that will not move

INFORMATION SHEET

XIII. Tools used in caulking (Transparency 4)

- A. Insulated caulking gun
- B. Heating chest
- C. Air pressure caulking gun
- D. Utility knife
- E. Drop-in cartridge caulking gun
- F. Caulking trowel or jointer

XIV. Purpose of waterproofing--Stop the flow of water through a wall

XV. Types of waterproofing and their uses

- A. Tuckpointing--Makes joints waterproof or weatherproof
- B. Joint waterproof--Fills small cracks with a grout mixture
- C. Silicone--Used mostly on vertical walls

(NOTE: This type of waterproofing has a water or solvent base.)

- D. Transparent waterproofing--Used on vertical walls and floors

(NOTE: It contains waxes and oils.)

- E. Bituminous coating of hot asphalt--Used on interior walls
- F. Cold tar or asphalt emulsion--Used on exterior foundation walls

XVI. Safety precautions to follow when waterproofing

- A. Make sure you have the proper staging
- B. Cover glass areas when brushing or spraying on silicones

(NOTE: Silicones will etch glass if not removed immediately.)

- C. Work in a well-ventilated area
- D. Wear protective clothing

Cleaning Equipment



Rubber Pail



Long-Handled
Acid Brush



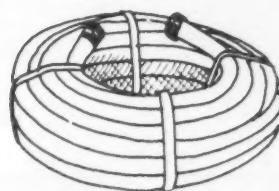
Rubber Gloves



Safety Goggles



Scraper



Water Hose with Nozzle

Tools For Repairing Brick or Block Walls



Plug or
Mash Hammer



Tuckpointer's Grinder



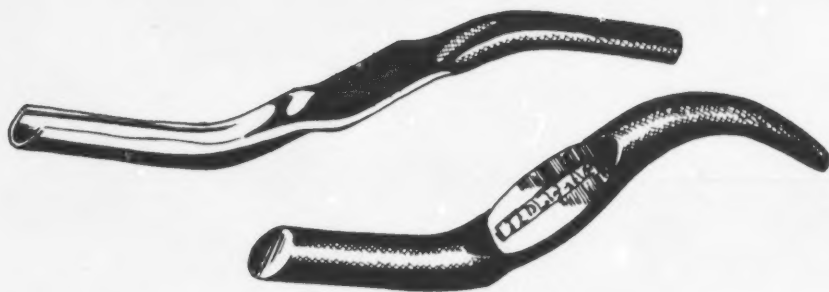
Flat Jointer



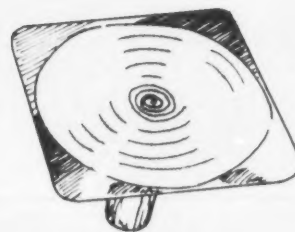
Soft Brush



Tuckpointer's Plugging Chisels



Round Jointers



Tuckpointer's Hawk

Caulking Procedure

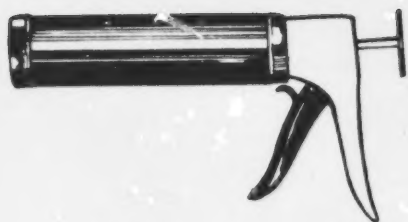


Caulking Control Joint or Expansion Joint

Perimeter Caulking



Tools Used In Caulking



Insulated Caulking Gun



Air Pressure Caulking Gun



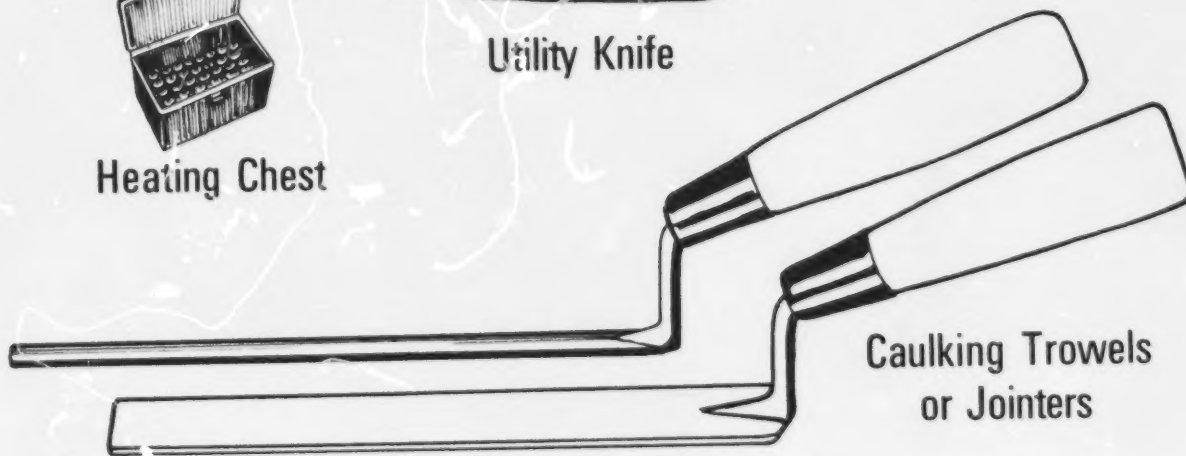
Drop-In Cartridge
Caulking Gun



Heating Chest



Utility Knife



Caulking Trowels
or Jointers

CLEANING, POINTING, AND CAULKING
UNIT I

JOB SHEET #1--REPAIR A BRICK OR BLOCK WALL

I. Tools and materials

- A. Tuckpointer's plugging chisel
- B. Plug or mash hammer
- C. Tuckpointer's grinder
- D. Flat jointers, assorted sizes
- E. Round jointers, assorted sizes
- F. Tuckpointer's hawk
- G. Soft brush
- H. Air pressure (if available)
- I. Water hose
- J. Fine, sharp sand
- K. Cement
- L. Lime
- M. Safety goggles
- N. Dust mask

II. Procedure

- A. Remove the mortar joints to a depth of at least 1/2" with hand or power tools
- B. Remove all loose materials with brush, air (if available), or water
- C. Mix pointing mortar to match existing mortar joints

(NOTE: Mix pointing mortar 1 to 2 hours ahead of time. Then remix so it will not be as wet as brick or block mortar.)
- D. Dampen joints with water spray or brush

JOB SHEET #1

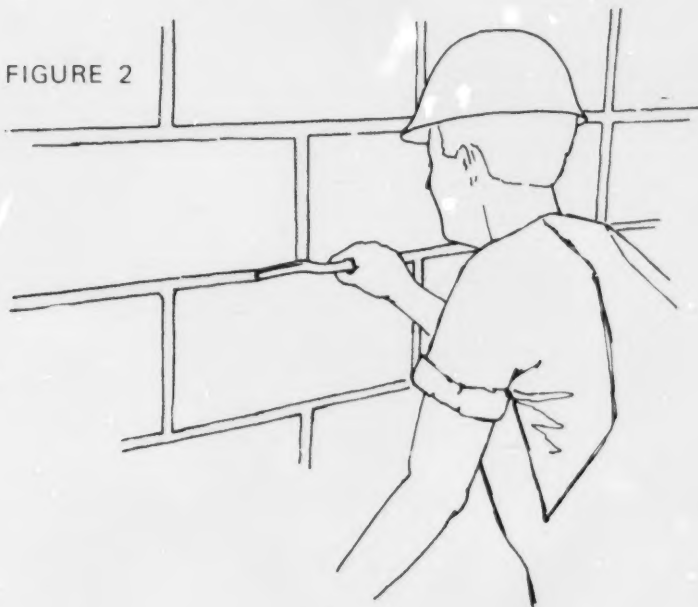
- E. Use flat jointer to push mortar in layers into joint until it is filled solid (Figure 1)

FIGURE 1



- F. Smooth out filled joints with round jointer (Figure 2)

FIGURE 2



JOB SHEET #1

- G. Brush off joints with soft brush to remove any burrs (Figure 3)

(NOTE: Do not stain brick or block facing when tucking mortar into open joints.)

FIGURE 3



CLEANING, POINTING, AND CAULKING
UNIT I

JOB SHEET #2--CAULK A DOOR AND/OR WINDOW FRAME
AND A CONTROL JOINT

I. Tools and materials

- A. Caulking guns
- B. Heating chest
- C. Window and/or door frame
- D. Control joint

II. Procedure for window and/or door frame

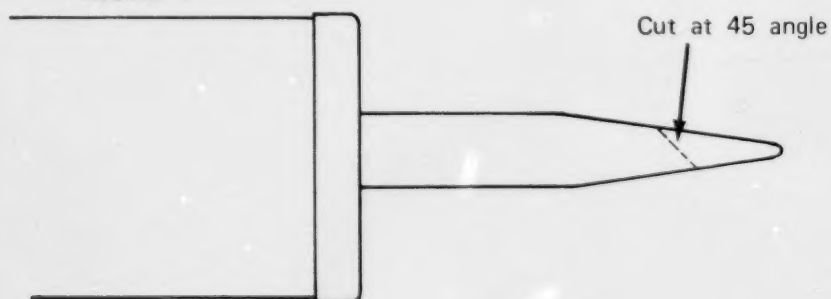
- A. Clean surfaces on frames and wall

(NOTE: Make sure surface is free of dust, oil, grease, wax, or any other foreign material.)

- B. Cut plastic tip of caulking tube at a 45° angle (Figure 1)

(NOTE: Cut angle at point to apply a 1/4" wide joint.)

FIGURE 1

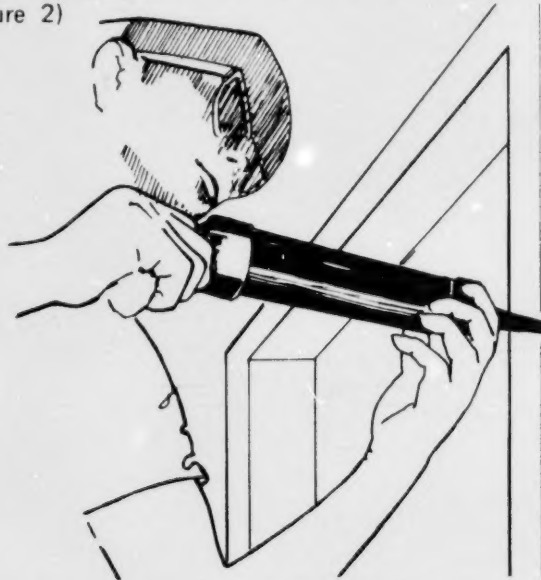


- C. Start at top of opening
- D. Hold gun at 45° angle and squeeze trigger

JOB SHEET #2

- E. Move along joint keeping 1/4" thick joint of caulking material at center of blade (Figure 2)

FIGURE 2



- F. Draw gun downward gradually, keeping pressure on trigger until you reach the bottom (Figure 3)

FIGURE 3

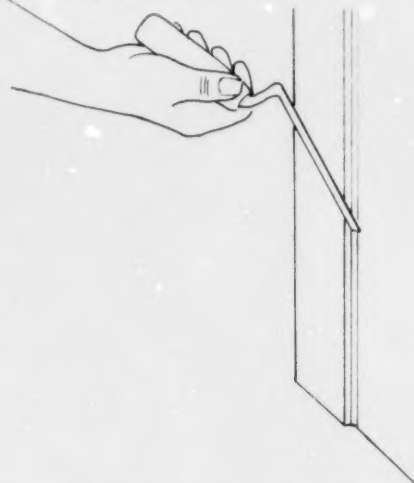


- G. Repeat procedures on other side
H. Move from left to right at top and bottom

JOB SHEET #2

- I. Smooth out caulking using a 1/4" flat jointer or a 1/4" caulking trowel (Figure 4)

FIGURE 4



- J. Dip jointer in a container of water or liquid soap and water to aid smoothing out joint

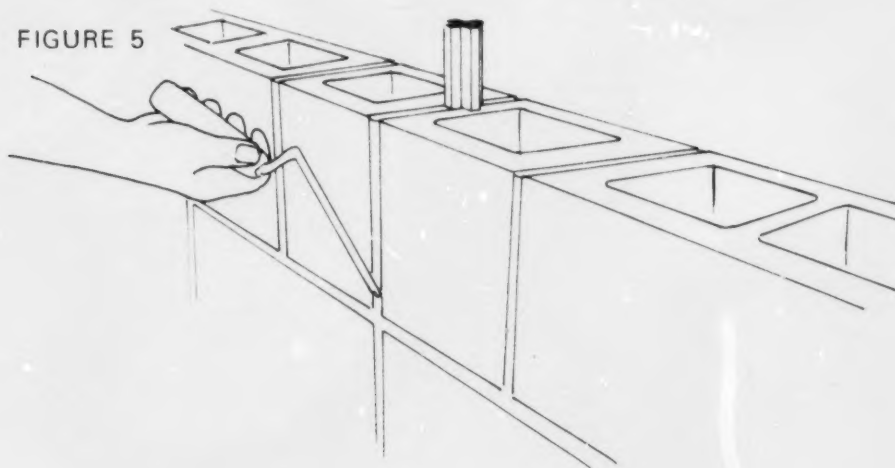
(CAUTION: Do not apply too much pressure with jointer when smoothing out caulking materials. Do not let caulk build up on jointer.)

- K. Clean caulking guns and tools when caulking has been completed

III. Procedure for a control joint

- A. Compact the control joint with the proper backing materials to within 1/2" of the face of the wall or as called for in specifications (Figure 5)

FIGURE 5



JOB SHEET #2

- B. Caulk control joint using same procedure used on door or window frames
- C. Hold caulking guns square (90°) to control joint and keep caulking material flush with face of wall
- D. Smooth out joint using same procedure that was used for window and door frames
- E. Clean tools and equipment

CLEANING, POINTING, AND CAULKING
UNIT I

TEST

1. Match the terms on the right to the correct definitions.

- | | |
|---|------------------|
| _____ a. Filling cut-out or defective mortar joints in masonry with fresh mortar | 1. Grout |
| _____ b. Cementitious component of high water-cement ratio, permitting it to be poured into spaces within masonry walls | 2. Muriatic acid |
| _____ c. Process of removing mortar stains or burrs from a finished wall section | 3. Efflorescence |
| _____ d. Mild solution of hydrochloric acid used for cleaning | 4. Tuckpointing |
| _____ e. Jointing or troweling mortar into a joint after masonry units are laid | 5. Pointing |
| _____ f. Powder or stain found on the surface of masonry, resulting from deposition of water-soluble salts | 6. Cleaning |

2. List the purposes of cleaning.

a.

b.

c.

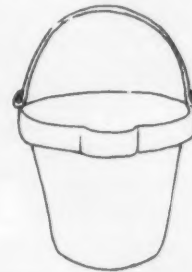
3. Identify the following cleaning equipment by writing the appropriate names in the blanks provided.



a. _____



b. _____



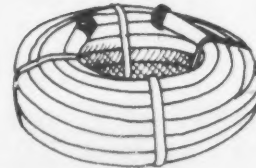
c. _____



d. _____



e. _____



f. _____

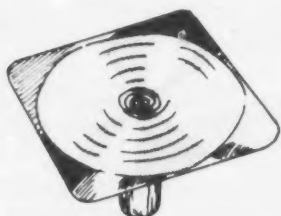
4. Name the types of cleaning materials used on masonry units.

a. _____

b. _____

5. Describe the cleaning procedure.

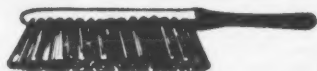
6. List five safety precautions to follow when cleaning.
- a.
 - b.
 - c.
 - d.
 - e.
7. State the purpose of pointing.
8. Identify the following tools used for repairing brick or block walls by writing the appropriate names in the blanks provided.



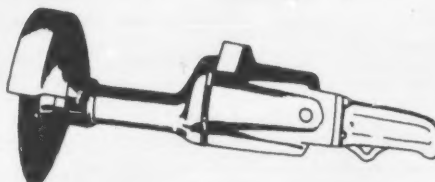
a. _____



b. _____



c. _____



d. _____



e. _____



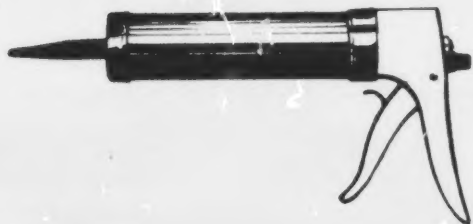
f. _____



g. _____

9. Describe the procedure for pointing.
10. Explain the difference between pointing mortar and brick mortar.
11. Select from the list below the purposes of caulking by placing an "X" in the correct blanks.
- _____ a. Prevent water penetration around window and door frames and brick and block panels
 - _____ b. Seal expansion joints and control joints
 - _____ c. Fill joints for precast concrete and panel-to-panel joints
 - _____ d. Hold water in walls
 - _____ e. Let water flow through wall
12. Match types of caulking to specific uses by placing the appropriate numbers in the blanks provided.
- | | |
|---|-------------------------------|
| _____ a. Used in narrow and wide joints in floors, decks, and sidewalks | 1. Acrylic terpolymer sealant |
| _____ b. Used for vertical and horizontal joints that will not move | 2. Polytremdyne sealant |
| _____ c. Used for all vertical and horizontal joints | 3. Oil-based caulking |

13. Identify the following tools used in caulking by writing the correct names in the blanks provided.



a. _____



b. _____



c. _____



d. _____

14. State the purpose of waterproofing.

15. Match types of waterproofing to their specific uses by placing the appropriate numbers in the blanks provided.

- | | |
|--|--------------------------------------|
| _____ a. Fills small cracks with a grout mixture | 1. Tuckpointing |
| _____ b. Used on interior walls | 2. Silicone |
| _____ c. Used on vertical walls and floors | 3. Joint waterproof |
| _____ d. Used mostly on vertical walls | 4. Bituminous coating of hot asphalt |
| _____ e. Makes joints waterproof or weatherproof | 5. Transparent waterproofing |
| _____ f. Used on exterior foundation walls | 6. Cold tar or asphalt emulsion |

16. Name three safety precautions to follow when waterproofing.

a.

b.

c.

17. Demonstrate the ability to:

a. Repair a brick or block wall.

b. Caulk a door and/or window frame and a control joint.

(NOTE: If the above activities have not been accomplished prior to the test, ask the instructor when they should be completed.)

CLEANING, POINTING, AND CAULKING
UNIT I

ANSWERS TO TEST

1. a. 4 d. 2
 b. 1 e. 5
 c. 6 f. 3
2. a. Removal of mortar, mortar stain, and other materials, such as dirt, deposited on masonry during construction
 b. Removal of efflorescence
 c. Removal of other stains that appear on new and old structures
3. a. Long-handled acid brush
 b. Safety goggles
 c. Rubber pail
 d. Scraper
 e. Rubber gloves
 f. Water hose with nozzle
4. a. Hydrochloric acid (muriatic)
 b. Manufactured cleaner other than acid
5. Description should include:
 a. Dry-clean walls
 b. Protect windows, doors, and trim
 c. Remove large particles of mortar with wood paddles and scrapers before wetting the wall
 d. Use sandblasting in some areas
 e. Flush off all loose mortar and dirt
 f. Soak the area to be cleaned with plenty of water just before applying acid

- g. Apply acid
 - 1) Fill a nonmetallic container about 3/4 full with clean water and add acid so mixture will be nine parts water to one part acid
 - 2) Place a small block of wood in container holding mixed material as a reminder that acid has been added
 - 3) Apply acid mix using a long-handled fiber brush
 - 4) Scrub as you apply
 - 5) Apply acid to an area that can be scrubbed and rinsed before it will dry
 - 6) Remove mortar stain that may have been missed when dry-cleaning by using a piece of brick, wood paddle, or scraper
 - 7) Rinse area washed with acid with plenty of water
 - 8) Keep metal, limestone, and cast stone well flushed with clean water
 - 9) Make sure water runs to the bottom of the wall when rinsing
- 6. Any five of the following:
 - a. Use a plastic or hard rubber container for mixing acid
 - b. Use a long-handled brush to apply acid
 - c. Wear protective clothing
 - d. Check staging planks for traps
 - e. Make sure no one is working below you
 - f. Do not throw objects off staging
 - g. Make sure guard rails are secure
 - h. Use swing scaffold only after proper instruction
- 7. To make joints weatherproof
- 8.
 - a. Tuckpointer's hawk
 - b. Plug or mash hammer
 - c. Soft brush
 - d. Tuckpointer's grinder

- e. Flat jointer
 - f. Round jointer
 - g. Tuckpointer's plugging chisel
9. Description should include:
- a. Remove mortar joints to a depth of at least 1/2"
 - b. Remove dirt and dust from joints
 - c. Wet joints thoroughly before pointing
 - d. Mix pointing mortar about one hour before time to be used
 - e. Remix pointing mortar, keeping it stiffer than regular brick mortar
 - f. Tuckpoint mortar into open joints so that joints are filled solid
10. Explanation should include:
- a. Pointing mortar--Portland cement, very fine sand, and lime mixed to a stiff consistency
 - b. Brick mortar--Portland cement, coarse sand, and lime mixed to a consistency that can be handled with a trowel
11. a, b, c
12. a. 2
- b. 3
- c. 1
13. a. Caulking gun
- b. Caulking trowel or jointer
- c. Utility knife
- d. Heating chest
14. Stop the flow of water through a wall

BRICKLAYING PROGRESS CHART

Section H

Cleaning, Pointing and Caulking

Student's Name

Unit I

Cleaning, Pointing and Caulking

Job	Unit	Test	Result

Repair a Brick or Block Wall
Caulk a Door and/or Window Frame
and a Control Joint

1

2

3

1

2

3

4

5

6

7

